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A MANUAL OF OBSTETRICS.

BY

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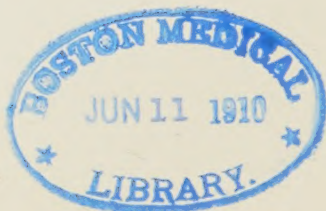
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TENTH EDITION, REVISED AND ENLARGED.

WITH THREE HUNDRED AND ONE ILLUSTRATIONS IN
TEXT AND THREE PLATES.



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DESIGNED IN PARTICULAR FOR
MY OWN STUDENTS,

IN THE
MEDICAL CLASSES OF THE GEORGE WASHINGTON
UNIVERSITY, WASHINGTON, D. C.,

AND THE
UNIVERSITY OF VERMONT;

TO THEM

This Book

IS AFFECTIONATELY DEDICATED,

WITH THE
EARNEST HOPE THAT IT MAY BE OF SERVICE TO THEM,
AND WITH THE BEST WISHES OF

THE AUTHOR.

PREFACE TO THE TENTH EDITION.

As stated in the Preface to the First Edition the chief purpose of this book is to present, in an easily intelligible form, such an outline of the rudiments and essentials of Obstetrics as may constitute a good groundwork for the student at the beginning of his studies, and one by which it is hoped he will be the better prepared to understand and assimilate the extensive knowledge and classical descriptions contained in larger and more elaborate text-books.

Whatever value the book may offer to the practitioner for purposes of reference, I cannot but hope it may prove of service to those whose onerous duties allow but little leisure for consulting larger works, and who simply desire to refresh their minds upon the more essential points of obstetric practice.

In the preparation of the Tenth Edition such additions and changes have been made as the progressive development of Obstetric Science seemed to require.

Some errors have been corrected and obsolete methods of practice omitted.

The chapter on "Fecundation and Nutrition of the Embryo" has been almost entirely re-written. Extensive changes have been made in the chapters on "Pelvic Deformities," "Cutting Operations upon the Mother," "Mutilating Operations upon the Child," "Placenta Prævia," and "Puerperal Septicæmia," together with numerous minor modifications on various subjects throughout the work.

For reference I have consulted most frequently the treatises of Williams, Hirst, Jewett, Edgar, Dorland, Davis, Reynolds, Wright, Webster, and Minot; also the "*Manual of Midwifery*" by Jellott of Dublin, and the two volumes on "*Antenatal Pathology and Hygiene*" by Ballantyne of London. To all of these authors it gives me pleasure to acknowledge my grateful indebtedness.

With regard to the illustrations, I have endeavored as far as practicable to acknowledge in each instance the source whence they were obtained. Altogether forty new engravings have been added to the present edition.

The new plates illustrating "Development of the Embryo," and the one showing "Peters' Ovary," were prepared under my direction by Mr. Henry S. T. Haines, an artist in the Bureau of Animal Industry of the United States Department of Agriculture.

The general scope of the work remains, as from the first, elementary, the main object being such brevity and simplicity of statement as might be easily intelligible to all students.

I thank the publishers most cordially for the attractive changes they have made in the preparation of the book, and for their faithful rendering of the colored plates and new illustrations. Nor must I fail to mention the great assistance received from their careful proof-reader while carrying the work through the press.

Gratified by the generous approval accorded past editions, I trust the present one may be found equally deserving and satisfactory.

A. F. A. K.

1315 MASSACHUSETTS AVENUE, N. W.,

Washington, D. C., 1907.

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OBSTETRICS.

CHAPTER I.

INTRODUCTION.—THE PELVIS.

OBSTETRICS is the science and art of midwifery. Its object is "the management of woman and her offspring during pregnancy, labor, and the puerperal state." In its wider scope it embraces a knowledge of the structure and functions of the reproductive organs and of their relations to the general system.

THE PELVIS.

The word "pelvis" means basin. It is a strong framework of bones, in which the reproductive organs are contained and to which they are attached, and its cavity contributes to form a canal through which the child must pass during parturition.

It is composed of the right and left innominate bones, sacrum, and coccyx.

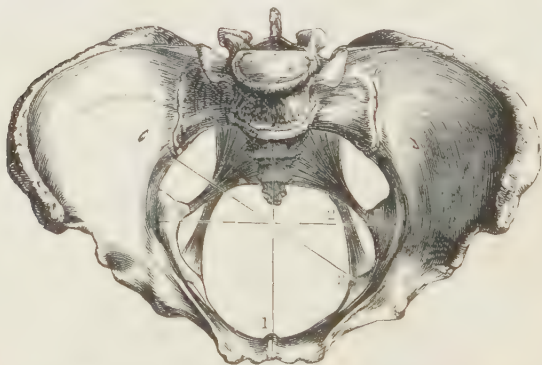
The Sacrum and Coccyx.—The following anatomical features of the sacrum are of obstetrical importance:

First, its *promontory*—the central, projecting, anterior border of the superior surface (or base) of the bone. From this promontory the antero-posterior diameter of the *brim* of the pelvic *basin* is measured, and a material reduction in its distance from the symphysis pubis, directly opposite, constitutes the *most common* variety of pelvic deformity. The *smooth convexity* of the anterior border of the promontory is important, for it causes the globular head of the child to glide off, during labor, to one or other side of the median line, where there is more room for it to pass, as will be explained hereafter.

Second. The *anterior concave surface* or “*hollow*” of the sacrum. It contributes to give amplitude and curvature to the pelvic canal. It is in conformity with this curvature of the sacrum that the long obstetrical forceps is made with what is called its “*sacral curve*.” Material increase or decrease in the degree of sacral curvature constitutes deformity, and may render labor mechanically difficult or impossible. Rarely bony tumors (*exostoses*) spring from the anterior surface of the sacrum and obstruct delivery. This surface of the bone is pierced by the anterior sacral foramina, which give exit to the anterior sacral nerves.

Third. Each *lateral surface* of the sacrum presents a rough, ear-shaped area—the *auricular, articular surface*—

FIG. 1.



1. Antero-posterior (conjugate). 2. Bis-iliac (transverse). 3. Oblique.

covered with cartilage, which joins a similar shaped surface on the iliac bone, constituting the *sacro-iliac synchondrosis*. The posterior ends of the *oblique diameters* of the pelvic brim terminate at the sacro-iliac synchondroses. That portion of the bone extending from the sacro-iliac synchondrosis to the side of the body of the first sacral vertebra is called the *wing (ala)* of the sacrum; one on each side, of course. (See Fig. 1.)

Fourth. The apex, or inferior extremity of the sacrum, presents a transversely oval facet, covered with cartilage, for articulation with a corresponding oval surface upon the coccyx.

The sacro-coccygeal articulation is an amphiarthrosis or mixed joint, furnished with a synovial membrane, and is movable; that is, the child's head during its passage out of the pelvis forces the coccyx backward, so as to leave more room between its tip and the symphysis pubis. In women past the prime of life this joint becomes ankylosed, the coccyx refuses to yield before the advancing head, and hence difficult labor.

Fifth. It is of the utmost importance to remember that the vertical measurement of the sacrum and coccyx, in the median line—*i. e.*, from the centre of the sacral promontory above to the tip of the coccyx below—the line of measurement being a chord of the sacro-coccygeal curve—is four inches and a half ($4\frac{1}{2}$) in length or 11.4 cm.; exactly *three times as long as the vertical depth of the symphysis pubis*, which is one inch and a half ($1\frac{1}{2}$) or 3.8 cm.

The Coccyx.—The coccyx is triangular in shape. It is composed of four rudimentary (caudal) vertebræ, which diminish in size from above downward. Its base is attached to the lower extremity of the sacrum, as already explained.

The Innominate Bone.—The internal aspect of the bone only requires study. There we find a prominent line or ridge beginning at the sacro-iliac synchondrosis, a little below the level of the sacral promontory, and extending obliquely forward, slightly downward, and at the same time describing a somewhat semicircular curve inward toward the median line, where it eventually joins its fellow of the opposite side at the symphysis pubis; this line is the *linea ilio-pectinea* of anatomists. It forms, with the sacral promontory, and two short ridges crossing the wings of the sacrum between the promontory and sacro-iliac synchondroses, a sort of cordiform outline, which is, in fact, the brim of the pelvic basin, or, technically, the *superior strait of the pelvis*. To recapitulate, the entire contour of the superior strait may be thus described: Beginning in the median line at the centre of the sacral promontory, it passes outward across one lateral half of the promontory until reaching the wing of the sacrum, then across the wing outward, forward, and slightly downward, until reaching the sacro-iliac synchondrosis, then it traverses the ilium and pubis, as just described, along the *linea ilio-pectinea*, until arriving at the spine of the pubis, and from thence to the symphysis pubis, and so on back, over the opposite side, until again

reaching the centre of the sacral promontory from whence it started. (See Fig. 1, page 18.)

The "false" pelvis, so-called, is all that portion of the pelvis situated *above* the superior strait, and is made up chiefly by the wings, crests, and spinous processes of the iliac bones. Its bony wall is deficient in front; hence it is, of course, an imperfect or "false" basin.

The "true" pelvis is all that portion of the basin situated *below* the brim. Its cavity is a little wider in every direction than the brim itself, while the false pelvis is a great deal wider; the brim is, therefore, a somewhat narrowed bony ring or aperture between these two; hence the term "strait" is given it.

In the cavity of the pelvis we find, on each side, the prominent *spine* (spinous process) of the *ischium* and the *inclined planes* of the ischium. The ischial spinous process projects from the posterior border of the body of the bone, about midway between the highest border of the great sciatic notch above and the lowest margin of the tuberosity of the ischium below. Its tip points at once downward, backward, and inward toward the median line, and extending from it forward and upward toward the upper margin of the acetabulum is an indistinct ridge of bone. Now the smooth, slanting internal surface of the ischium in front of and below this indistinct ridge is called the *anterior inclined plane of the ischium*, or the *anterior inclined plane of the pelvis*—no matter which. Note, however, its direction: it slants downward, *forward*, and inward toward the median line; so that a rounded body like the foetal head, coming down from above and impinging upon it, would glide at once *lower down, more forward*, and also *inward toward* the pubic symphysis. Hence it is instrumental in producing what is called "*anterior rotation*" of the occiput in the mechanism of labor.

Of course, there is an "inclined plane" of this sort on both sides of the pelvis, called respectively the *right* and *left anterior inclined planes*.

The *posterior inclined planes of the pelvis* are rather difficult to define, but we may map them out as follows: Draw a line on the inner surface of the pelvic cavity from the *spinous process* of the ischium to the *ilio-pectineal eminence* (in most pelves an indistinct ridge may be observed along this line). This

line divides the anterior from the posterior inclined plane. But as there is only a small remaining surface of the ischium *behind* the dividing line to form the *posterior* plane, it is evident that, in the living woman, this plane is completed by the sacro-sciatic ligaments and the muscular structures, etc., that fill up and cover the sacro-sciatic foramina. In a dried pelvis, therefore, especially when divested of its sacro-sciatic ligaments, it is possible to see only a very small part of the posterior inclined plane, viz., that part where it begins on the back of the dividing line just mentioned. Its continuance or extension downward and backward to the median line of the hollow of the sacrum can only be seen when the muscles and ligaments are intact; and of which, in fact, the larger portion of the posterior inclined plane is made up.

The posterior inclined plane causes the presenting part of the child impinging upon it to rotate downward, *backward*, and inward toward the median line of the sacrum. Of course, there is a posterior inclined plane on each side—right and left.

Complete ossification of the pelvic bones does not take place till about twenty years of age, which affords a probable explanation why a first labor is generally more easy during the early part of adult life than later. The bones yield a little, and, after labor is over, the pelvis probably retains to some extent the size and shape acquired by the first early delivery, so as to render subsequent labors more easy.

After *thirty* years of age the *sacro-coccygeal joint* may become firmly ankylosed and ossified so as to prevent yielding of the coccyx before the pressure of the child's head, thus adding another obstacle to delivery.

The Sacro-sciatic Ligaments.—The greater sacro-sciatic ligament (sometimes called the “posterior” one) arises from the posterior inferior spinous process of the ilium, the lower part of the lateral margin of the sacrum, and from the coccyx: it is inserted into the *tuberosity* of the ischium. The *lesser* (or “anterior”) sacro-sciatic ligament arises from the lateral margin of the sacrum and coccyx, and is inserted into the *spinous process* of the ischium.

These ligaments convert the great sciatic notch into the great sciatic foramen, and the lesser sciatic notch into the lesser sciatic foramen.

The Great Sacro-sciatic Foramen.—The great sacro-sciatic foramen transmits the pyriformis muscle, the gluteal vessels and nerve, the ischiatic vessels and nerves, the internal pudic vessels and nerve, and the nerve to the obturator internus muscle.

The Lesser Sacro-sciatic Foramen.—The lesser sacro-sciatic foramen transmits the tendon of the obturator internus muscle, its nerve, and the internal pudic vessels and nerve.

The Obturator or Thyroid Foramen.—The obturator or thyroid foramen is situated in the antero-lateral part of the pelvic wall, between the pubis and ischium, sometimes called the “foramen ovale.” It is bridged over by a strong membranous web of ligamentous tissue, called the *obturator membrane*, from the inner and outer surfaces of which arise, respectively, the internal and external obturator muscles. The obturator vessels and nerve pass through an aperture in the upper margin of the obturator membrane.

The Pubic Arch.—The pubic arch is formed by the two descending rami of the pubes, and (in the female) its inner smooth surface, lined at its central upper part by the subpubic ligament, is of such a size and shape as to be absolutely in unison with and adapted to admit the passage of the sides and base of the occipital pole of the fetal head, as we shall see in describing the mechanism of labor in vertex presentations.

The Inferior Strait or “Outlet” of the Pelvis—The dried bony pelvis, divested of its muscular appendages, is a basin without a bottom. The opening where the bottom ought to be is the inferior strait or outlet. Its contour may be described, in particular, as follows: Beginning at the summit of the pubic arch, in the median line of the body, it passes downward and backward along the inner margin of the descending ramus of the pubes and the ramus of the ischium until reaching the tuberosity of the ischium, then along the great sacro-sciatic ligament to the side of the sacrum and coccyx, and tip of the latter bone; then back along the opposite side of the pelvis to the point of starting at the pubic arch. (See Fig. 2, page 23.)

Articulations of the Pelvis:

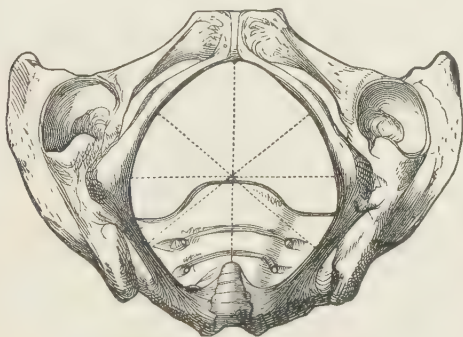
First. The hinge-joint of the base of the coccyx with the apex of the sacrum (the *sacro-coccygeal articulation*).

Second. The junction of the auricular-shaped articular sur-

face of the side of the sacrum, with a similar shaped surface upon the adjacent ilium, the articular surface on both bones covered by a plate of cartilage. This is the *sacro-iliac synchondrosis*.

Third. The *symphysis pubis*, formed by the apposition of the two bodies of the pubic bones in the median line. The articular surfaces are roughened by a series of nipple-shaped projections which dip into the layers of cartilage that cover them. These plates of cartilage are thicker in front than behind: they also diverge from each other posteriorly, especially at the upper part of the articulation, leaving a little space which is occupied by a synovial membrane, while lower down

FIG. 2.



Inferior strait, or outlet of pelvis.

the interarticular space is filled with fibrous elastic tissue. The joint is further strengthened by several layers of the anterior pubic ligament in front; the posterior pubic ligament behind; the superior pubic ligament above; and below by a thick, triangular arch of ligamentous tissue (the subpubic ligament), which forms the upper boundary of the pubic arch. The joint is rendered still more secure by the dense membrane of the deep perineal fascia (triangular ligament), the apex of which is attached above to the symphysis pubis and subpubic ligament, and extends laterally to the rami of the ischia and pubes, thus bracing the sides of the arch together as the sides of the gable-end of a house are braced together by cross timbers.

Fourth. The *lumbo-sacral articulation*, where the inferior aspect of the body of the last lumbar vertebra (covered with cartilage) rests upon the superior surface of the base of the sacrum, which is also covered by a cartilaginous plate. These two layers of intervertebral cartilage are much thicker in front than behind, which, of course, tilts the sacrum backward, and contributes to form the promontory.

Fifth. The *hip-joint*, but with regard to this we need only remember the *position* of the acetabulum in relation to the pelvic brim; it is situated near the antero-lateral part of the brim's circumference—in fact, nearly obliquely opposite the sacro-iliac synchondrosis of the other side, which is, of course, placed in the *postero-lateral* part of the pelvic circumference.

Planes of the Pelvis.—The *inclined* planes of the ischium, sometimes called *inclined* planes of the *pelvis*, already studied, have nothing whatever to do with the planes of the brim, outlet, and pelvic cavity, now to be considered. Let it be distinctly understood that the “planes” and “*inclined*” planes are different things.

If we fill an ordinary basin with water, and float upon the surface a disk of paper whose circumference shall accurately fit the rim of the basin, the surface of the paper disk would represent the *plane of the brim* of that particular basin; in like manner, a disk of paper placed in the superior strait of the pelvis so that its circumference accurately fits the contour of the pelvic brim, would represent on its surface the “*plane of the superior strait*,” or brim, of the pelvic basin. A disk of paper, similarly placed, in the outlet or inferior strait, would represent on its surface the “*plane of the inferior strait*,” or outlet, of the pelvis. The surfaces of other disks placed at intermediate depths between the superior and inferior straits (such as might be imitated in the earthen basin by its different degrees of fulness) would constitute *planes of the pelvic cavity*, which latter might, of course, be multiplied in number indefinitely.

The *axis* of the plane of the superior strait is an imaginary line passing through the *centre* of the plane, at *right angles to its surface*, just as an axle-tree passes at right angles through the centre of a cart-wheel.

Owing to the anterior inclination of the pelvis when the woman stands erect, the brim is, as it were, tilted up behind,

so that the plane rests at an angle of about 60° with the horizon. Hence, therefore, its axis, instead of being vertical, is so disposed as nearly to agree with a line drawn from the umbilicus to the coccyx.

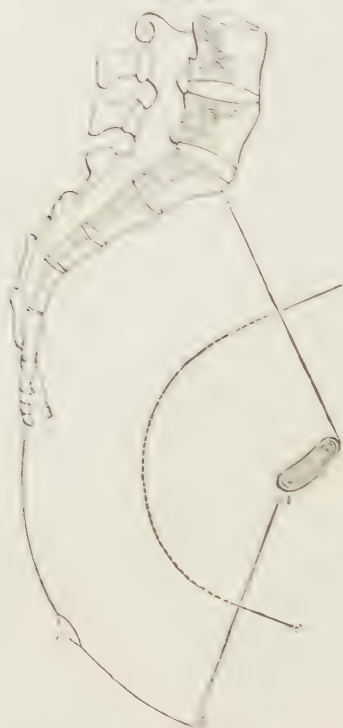
The plane of the outlet is more nearly horizontal than that of the superior strait, but it is still elevated posteriorly, so that a line drawn from the tip of the coccyx to the highest point of the pubic arch will meet the horizon at an angle of about 11° , which, however, is subject to variation, inasmuch as the pressing *back* of the coccyx during labor also presses its tip *downward* to some extent, which, of course, renders the angle more acute. The *axis* of the plane of the inferior strait nearly agrees with a line drawn from the sacral promontory to the anterior verge of the anus.

The axes of the planes of the pelvic cavity are lines drawn through the centres of the planes at right angles to their surface. The axes of a great number of such planes, placed end to end, would form an imperfectly circular curve, or at least a polyhedral arc of a curve, which would represent the real *axis of the pelvic canal*. (Carus attempted to describe this curve (hence known as "Carus's curve") by placing one leg of a pair of compasses on the middle of the posterior edge of the symphysis pubis (in a bisected pelvis), the other leg of the compass having its point placed midway between the pubis and sacrum, and being moved so as to describe a curve from the superior to the inferior strait. But the true axis of the pelvic canal is not so geometrically perfect an arc of a circle as to admit of being drawn in this manner; it is more nearly the curve of an irregular parabola. (See Fig. 3, page 26.)

The pelvic canal in the living female does not really terminate at the inferior strait. In so far as its osseous walls are concerned it does, but the muscles and soft parts below form a continuation of the canal, and when these are stretched during parturition the posterior wall of the lower muscular part of the canal, viz., from the coccyx to the mouth of the vagina, measures quite as much as does the upper bony part, viz., from the coccyx to the sacral promontory. The *anterior* wall of the muscular part of the passage, corresponding with the pubis of the bony part, is, of course, deficient, and necessarily so, or the child could never be extruded in delivery. (See Fig. 3, page 26.)

The female pelvis differs from that of the male exactly in those particulars which render it better adapted to facilitate parturition, notably : first, in being altogether *wider* in every direction, which gives *more room* for the child to pass : and (second) in being altogether *shallower*, which *lessens the dis-*

FIG. 3.



Axis of the pelvic canal.

less through which the child has to be propelled ; and (third) the bones are thinner and smoother.

In the female pelvis the pubic arch is broader and rounder, the hollow of the sacrum is less curved, especially as regards its three upper segments, which are almost straight, the

obturator foramen is larger, and a little farther, laterally, from the symphysis pubis; the sacral promontory, ischial spinous processes, and tip of the coccyx are less prominent (so that they encroach to a less degree upon the cavity of the pelvic canal), and the sacro-sciatic notches are more spacious than in the male.

Changes Taking Place in the Female Pelvis toward the End of Pregnancy.—The interarticular cartilages become *thicker*; the ligaments *softer and somewhat relaxed*; synovial fluid is formed more plentifully in the articulations; and the joints become, *to an exceedingly limited extent, movable*, so as to be capable of yielding a very little, if necessary, to permit the passage of the child. The swollen cartilages also act as cushions between the bones, thus lessening the mechanical shock of falls, etc., somewhat like the “buffers” of railway cars.

Proof That the Joints Actually Yield during Labor.—Proof that the joints actually yield during labor is inferred not only from the fact of its occurrence in the lower animals (in the guinea-pig the symphysis pubis separates an inch, so that the sacro-iliac synchondrosis plays the part of a hinge-joint; and in the cow the sacrum sinks down between the innominate bones, so as to push them wider apart), but also from the circumstances that in women dying during labor separation of the bones has been found on dissection; and in certain cases where the physiological loosening of the articulations has been pathologically exaggerated, locomotion has been interfered with, and the pubic symphysis found separated an inch or more. Again, if the pulp of the index finger be placed upon the lower end of the symphysis, at the summit of the pubic arch, and kept there while the woman walks, or stands first on one foot, then on the other, the bones on each side of the symphysis will be felt to glide up and down with each step, the side corresponding to the advancing limb being lower than the other. This is more marked in multiparæ; may be unappreciable in primiparæ. It can be observed toward the end of pregnancy.

Measurements of the Pelvis.—The object of measuring the pelvis is to compare the length of its diameters with the diameters of the child that passes through it; without this it would be impossible to understand the mechanism of labor or to render suitable assistance in cases of difficult delivery.

The size of the pelvis is not the same in all women. It differs in different races of mankind and in different individuals of the same race. There is no reason why the pelvis of any two women should be more exactly alike than the length of their feet or the features of their faces.

There are no means by which we can measure with precision (say within one-fifth or even one-fourth of an inch) the diameters of the pelvis in a living female; our measurements under such circumstances can only *approximate* the truth. Neither are there any means by which we can measure any more accurately the diameter of a child's head before it is born; we can scarcely do better than guess even its *approximate* measurements.

Hence there is no practical use in trying to define and teach the measurements of the average female pelvis with that extreme precision (down to the smaller fractions of an inch) attempted in many obstetric text-books. It complicates the matter without any special advantage; an approximate precision is all that is requisite—all that is possible.

Diameters of the Superior Strait (see Fig. 1, page 18):

First. The *antero-posterior* (sacro-pubic, "conjugate," "*conjugata vera*," or true conjugate), extending from the middle of the sacral promontory to the *top* of the symphysis pubis.

Second. The *transverse* (bis-iliac), extending across the widest part of the strait, from one lateral margin of the brim to the other.

Third. The *right oblique* (*diagonalis dextra*), extending from the right sacro-iliac synchondrosis to the left acetabulum (or left ilio-pectineal eminence, which is nearly the same thing).

Fourth. The *left oblique* (*diagonalis laeva*), extending from the left sacro-iliac synchondrosis to the right acetabulum.

Fifth. The *diagonal conjugate* (*conjugata diagonalis*), extending from the middle of the sacral promontory to the *lower end* of the pubic symphysis. Since the pubic end of this diameter is really at the *inferior* strait, it is not, strictly, one of the diameters of the *superior* strait, but a diagonal between the two straits, as its name expresses. (See Fig. 4, *d-c*, p. 29.)

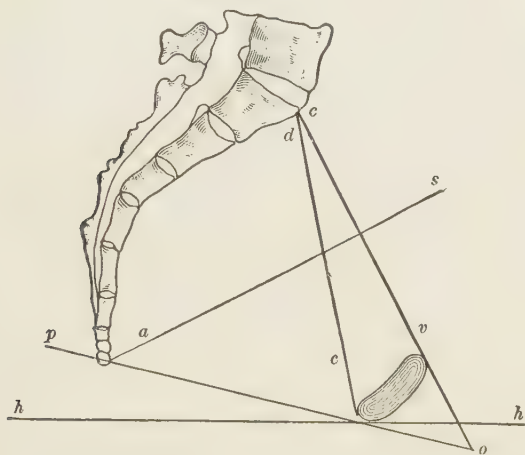
Diameters of the Inferior Strait (Fig. 2, page 23):

First. The *antero-posterior* (coccy-pubic, called also "conjugate"), extending from the tip of the coccyx to the lower end of the symphysis pubis.

Second. The *transverse* (bis-ischiatic), extending across the outlet from one tuberosity of the ischium to the other.

Third. The *oblique* (of which, of course, there are two, right and left, as at the brim), extending from about the middle of the lower border of the great sacro-sciatic ligament of one side to the thickened portion of bone where the descending ramus of the pubis joins the ascending ramus of the ischium, or thereabouts, on the other.

FIG. 4.



c-v. Conjugate diameter of superior strait. *d-c.* Diagonal conjugate. *a-s.* Axis of plane of superior strait. *p-o.* Plane of the outlet, or inferior strait. *h-h.* Line of the horizon. In this figure the woman is supposed to be standing erect.

Diameters of the Pelvic Cavity :

First. The *antero-posterior* (conjugate), extending from the centre of the symphysis pubis to the centre of the hollow of the sacrum.

Second. The *transverse*, extending across from a point nearly opposite the lower edge of the acetabulum on one side to a corresponding point upon the other.

Third. The *oblique* (of which there are two, right and left), extending from the centre of the great sacro-sciatic foramen on one side to the obturator foramen on the other.

(The diameters of the *cavity* are not so important as those of the brim and outlet.)

The Average Approximate Length.—The average approximate length of the diameters of the pelvic canal in the living woman is as follows :

Antero-posterior of the brim, or

superior strait 4 inches, 10.1 cm.

Transverse of the brim in the

living female 4 inches, 10.1 cm.

(The transverse is 5 inches, 12.7 cm., in the dried pelvis, owing to the removal of the psoas magnus muscle, which takes up half an inch of space on each side in the recent pelvis.)

Obliques of the brim (right and

left alike) $4\frac{1}{2}$ to 5 inches, 11.4 to 12.7 cm.

Diagonal conjugate $4\frac{1}{2}$ inches, 11.4 cm.

Antero-posterior of the outlet or

inferior strait $4\frac{1}{2}$ to 5 inches, 11.4 to 12.7 cm.

Transverse of the outlet . . . 4 inches, 10.1 cm.

Obliques of the outlet (right

and left alike) 4 inches, 10.1 cm.

Antero-posterior of the cavity . 5 inches, 12.7 cm.

Transverse of the cavity . . . 5 inches, 12.7 cm.

Obliques of the cavity (right

and left alike) 5 inches, 12.7 cm.

The most important fact developed by these measurements is that the brim is longest in its oblique diameters, while the outlet is longest in its antero-posterior measurement, which explains the necessity of what is called "rotation" in the mechanism of labor.

In addition to these measurements of the pelvis it is necessary to remember the depth of its walls ; thus, the depth of the *anterior wall*—*i. e.*, from the top to the bottom of the symphysis pubis—is $1\frac{1}{2}$ inches, 3.8 cm. ; while the depth of the *posterior wall*, from the sacral promontory to the tip of the coccyx (the line being a chord of the sacro-coccygeal curve),

is just three times as long, viz., $4\frac{1}{2}$ inches, 11.4 cm. The depth of the lateral wall is not of much importance; it is about $3\frac{1}{2}$ inches, 8.8 cm. In measuring the pelvis of the living woman *externally*, for the detection of deformity, it is especially necessary to remember the following:

1. Between the widest part of the iliac crests (inter-cristal diameter) $10\frac{1}{2}$ inches, 26.6 cm.
2. Between the anterior superior spinous processes of the ilia (inter-spinous diameter) $9\frac{1}{2}$ inches, 24.1 cm.
3. Between the front of the symphysis pubis at its upper end, and the depression just below the spinous process of the last lumbar vertebra (conjugate diameter) . . $7\frac{1}{2}$ inches, 19 cm.
4. Between the *anterior* superior spinous process of *one* ilium, and the *posterior* superior spinous process of the *other* (the oblique diameter) . . 9 inches, 22.8 cm.

In measuring the conjugate externally, a deduction of $3\frac{1}{2}$ inches (8.8 cm.) must be allowed for the soft parts and thickness of the bones, which, when subtracted from the $7\frac{1}{2}$ inches (19 cm.) of the external measurement, leaves 4 inches (10.1 cm.)—the normal conjugate of the brim, as we have already seen.

The above measurements, of course, refer to *normal* pelves. Numerous other measurements, employed for the detection of special forms of pelvic deformity, will be considered with the diagnosis of those abnormalities. (See Chapter XXII., on "Pelvic Deformities.")

Muscular Structures of the Pelvis.—*Above* the brim the muscles of the abdominal walls complete the wall of the "false" pelvis, where its bony wall is deficient in front, and they form the abdominal cavity, roofed above by the diaphragm, which

agrees somewhat in shape with the full-term gravid uterus, so that by the contraction of the abdominal muscles and diaphragm during the pains of labor the womb is tightly embraced by them, and assisted in its expulsion of the child. At the brim we find the *psoas magnus*, which, arising from the side of the last dorsal and from the sides of all the lumbar vertebrae, passes down and crosses the brim, where it takes up half an inch of space at each end of the transverse diameter of the superior strait, to be inserted, with the conjoined tendon of the *iliacus internus* muscle, into the lesser trochanter of the femur. The action of these two muscles is to flex the thigh upon the pelvis and rotate the femur outward, and as this is the posture usually assumed by the parturient female, the muscles are prevented from being stretched taut, and thereby encroach less on the brim and thus offer less obstruction to the passage of the child.

Structures Forming the Floor of the Pelvis and Making a Bottom to the Basin.—The pelvic floor (‘‘pelvic diaphragm’’) is composed, chiefly, of fascia, muscles, and connective tissue. Its superior surface is lined by peritoneum. Next below, and in close contact with the peritoneum, comes the tough, elastic, ‘‘internal pelvic fascia,’’ which is attached to the pelvic brim. Here it meets from above the fascia transversalis of the abdominal wall and the fascia lining the iliac fossae. Below the brim it is firmly attached to the periosteum, and forms a tendinous arch (*arcus tendineus*) reaching from the inner border of the pubes to the spine of the ischium: from this arch it extends to the median line of the body. Immediately below the internal pelvic fascia are two thin muscles, viz.: 1st. The *levator ani*, each half of which arises from the body and horizontal ramus of the pubes and from the *arcus tendineus*, and passes downward and inward to meet its fellow of the opposite side in the median line, where it is inserted into a tendinous raphe extending from the coccyx to the rectum, while some fibres pass between and to the sides of the bladder and rectum, and to the vaginal and rectal sphincters. 2d. The *ischio-coccygeus* (called also simply ‘‘coccygeus’’), which is a narrow, triangular slip, situated parallel with and posterior to the levator ani, closing in a little space which the latter muscle, as it were, failed to cover. It arises by its apex from the ischial spinous process, and is inserted into the side

of the coccyx. Below these muscles the pelvic floor is further strengthened by another layer of fascia—the *perineal fascia*. Its posterior portion—consisting of a single layer—is attached to the sides of the pelvis and *arcus tendineus*, from whence it is reflected over the inferior surface of the levator ani muscle, while its anterior part is divisible into a *deep* layer (covering the lower surface of the levator ani), a *median* and a *superficial* layer. Within these latter layers are lodged the pudic vessels and nerves, and the superficial muscles of the perineum. These muscles are (1) the *constrictor vaginae*, each lateral half of which arises, posteriorly, from the perineal fascia midway between the anus and ischium (a small slip only passing to join the sphincter ani muscle), and passes forward to unite, by aponeurosis, with its fellow of the opposite side, near the clitoris; (2) the *sphincter ani*, which arises from the tip of the coccyx and is inserted into the tendinous centre of the perineum; (3) the *transversus perinei*, a narrow, transverse slip arising from the ascending ramus of the ischium, and inserted into the sides of the vagina and rectum.

To the several structures of the pelvic floor above given must now be added the integument and the very numerous interstitial layers of elastic connective tissue, which latter weld the parts together and add strength and elasticity to the whole fabric.

Besides their motor function, the muscles covering the inner surface of the pelvis (including the pyriformis—not yet mentioned—which arises chiefly from and covers the hollow of the sacrum) provide a sort of muscular upholstery to the interior of the pelvis, by which its bony lines and prominences are cushioned over, so as to prevent injury to the soft parts during the passage of the child, while the infant itself receives the same protection.

CHAPTER II.

THE FŒTAL HEAD.

THE head of the fœtus requires special study, because, from its size and incompressibility, it is the most difficult part of the child to deliver : when the head is born, the rest of the labor is usually complete in a few minutes. The child's head, however, is not absolutely incompressible. Its bony wall is elastic to a certain extent in all parts except the base. By this arrangement, yielding of the bones permits pressure only upon the *upper part* of the fetal brain, where, when moderate in degree, it is harmless ; the same pressure upon the *base of the brain* and *medulla* would be fatal. While it is not true that the short transverse diameter of the child's head, viz., from one parietal protuberance to the other, is less than the transverse diameter of the trunk, viz., from one acromion process of the scapula to the other, still the bones and muscles of the arms, shoulders, and trunk are so mobile and flexible that, when they are jammed into the pelvis, the bisacromial diameter is capable of being easily reduced to a less width than the transverse diameter of the skull ; hence the head, though apparently *not*, practically *is* wider than across the shoulders.

Shape of the Fœtal Head. This does not correspond perfectly to any geometrical figure, but it will best suit our purpose to consider it ovoid or egg-shaped—the chin corresponding to the small end of the egg, the occiput to the large end, and the widest transverse circumference passing over the parietal protuberances. One aspect of the ovoid, viz., its base, is considerably flattened, and so are the sides of the head, but to a less extent.

The fetal cranial bones are imperfectly ossified (and are therefore elastic) ; their sutural borders are surmounted by a rim of cartilage, and the cartilaginous rims of two contiguous bones are only united by bands of fibrous tissue which become

ossified later. The bones are further held in apposition by the dura mater, pericranium, and skin; their borders, however, can be pressed closer together, or even made to lap one over the other, during parturition. The posterior borders of the parietal bones especially overlap the anterior borders of the occipital. The union of the upper, squamous part of the occipital bone with its basilar portion being only fibro-cartilaginous in character, this junction is somewhat movable, like a joint; hence pressure upon the prominence of the occiput easily depresses its anterior borders beneath the posterior borders of the parietal bones. The distance between the two malar bones can be reduced, by compression, only in a very slight degree.

The base of the skull is sufficiently ossified as to be *incompressible*; it is, however, narrower than the top of the skull, and needs no reduction in size to facilitate its passage through the pelvis in ordinary cases.

Sutures of the Cranium.—They are:

First. The *coronal suture* (or *fronto-parietal*), passing between the posterior border of the frontal bone and the anterior borders of the two parietals. It goes over the arch of the cranium from one temporal bone to the other.

Second. The *sagittal suture* (or *biparietal*), running along and between the superior borders of the two parietal bones and extending from the superior point of the occiput to the os frontis. It must be noted, however, that, in the fœtus, the two halves of the frontal bone have not yet united; they are divided by what is called the *frontal suture* almost to the root of the nose, and by some writers this frontal suture is regarded as a continuation of the sagittal.

Third. The *lambdoidal suture* (or *occipito-parietal*), running between the superior, or rather antero-lateral, borders of the occiput and the posterior borders of the parietals, and extending from near the mastoid process of one temporal bone to that of the other.

Fontanelles.—The *fontanelles* are spaces left in the skull at points where the angles of two or more bones finally meet. They are due to deficient ossification, and are explained by the general principle that ossification, beginning near the centre of a bone and extending toward its circumference, reaches the angles last because they are generally furthest from the centre. There are six fontanelles, but only *two* of them are

of obstetric importance. These are the *anterior* (or fronto-parietal) fontanelle and the *posterior* (or occipito-parietal) one.

The shape of the *anterior* one may be approximately described by drawing lines between the four points of a crucifix ; it is a four-sided figure, two of whose sides are equal—lozenge-shaped—the long, acute angle being formed by deficient ossification in the posterior superior angles

of the two halves of the frontal bone, and the short obtuse angle by deficient ossification in the anterior superior angles of the parietal bones. Its situation is where the coronal suture crosses the sagittal. In size it is a considerable membranous space, easily recognized by the finger, and often by the eye, and through it the motion of pulsation in the cerebral arteries may be both seen and felt. It is not completely closed till one or two years after birth. Remember particularly that the *long* angle of this fontanelle points toward the forehead

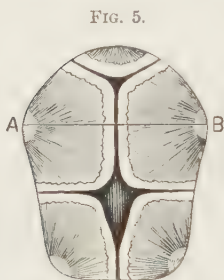


FIG. 5.
Showing the shape of fontanelles, the long acute angle of the anterior one pointing toward the nose. A B. Bi-parietal diameter.

and nose ; the short one toward the occiput. (See Fig. 5.)

The *posterior* fontanelle is much smaller in size, being simply a triangular depression situated at the point where the sagittal suture meets the lambdoid ; radiating from it are *three* sutural arms, viz., the sagittal suture and the two arms of the lambdoid. It closes a few months after birth.

The other four fontanelles, two on each side, are placed at the inferior angles of the parietal bones. They are unimportant.

Regions of the Fœtal Skull.—One of the most important is the vertex. Literally this means the highest part or “crown” of the head ; but when in midwifery we speak of a “vertex presentation,” we refer to a more posterior region of the skull, which I have already compared to the larger, rounded extremity of an egg, and which has (I think very properly) been termed by some writers the “obstetrical vertex” ; it may be defined as a circular space whose centre is the apex of the posterior fontanelle, and the circumference of which passes over the occipital protuberance.

Other regions of the fetal head have been described, but they are not of great importance. viz., the "base" or flattened surface directed toward the neck, and the facial, frontal, and lateral regions, which explain themselves.

The space occupied by the anterior fontanelle is sometimes called *sinciput*, or *bregma*.¹

Diameters of the Child's Head, and Their Approximate Average Length. (Fig. 6, page 38.)

- The *occipito-mental*, extending from the point of the chin to the superior angle of the occiput 5½ inches, 14 cm.
- The *occipito-frontal*, extending from the centre of the forehead to a point on the median line of the occiput a little above its protuberance 4½ inches, 11.4 cm.
- The *bi-parietal*, passing transversely from one parietal protuberance to the other 3½ inches, 8.8 cm.
- The *cervico-bregmatic* (called also "trachelo-bregmatic"), passing vertically from the posterior angle of the anterior fontanelle to the anterior margin of the foramen magnum 3½ inches, 8.8 cm.
- The *fronto-mental*, going from the top of the forehead to the end of the chin . 3½ inches, 8.8 cm.
- The *bi-temporal*, going across from one temporal bone to the other, between the two lower extremities of the coronal suture 3¼ inches, 8.2 cm.
- The *suboccipito-bregmatic*, going from the union of the neck and occiput to the centre of the anterior fontanelle . . 3¾ inches, 9.5 cm.

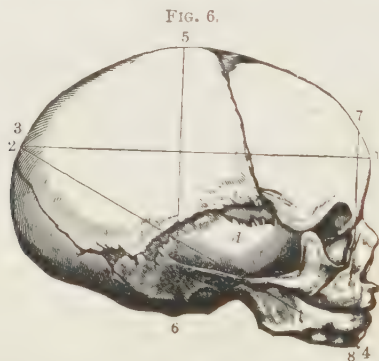
Several other cranial diameters are given in some of the text-books, and the number might be indefinitely multiplied, but the above are all that require to be remembered.²

¹ The terms "*vertex*," "*sinciput*," and "*bregma*" are defined so differently by different authors that I shall avoid using them as far as practicable. See Appendix on Uniformity in Nomenclature, etc., at the end of this book.

² It should be noted that the head may be pressed out of its natural shape ("moulded") during delivery, and the direction of such distortion will vary

One other measurement (of great importance when considering the mechanism of face presentations) may be added, viz., the sterno-mental length of the child's *neck* when the chin is removed as far as possible from the sternum, it is $1\frac{1}{2}$ inches—exactly the same as the depth of the symphysis pubis.

Articulation and Movements of the Head.—The motions of flexion and extension are provided for, in part, by the articulation of the occipital condyles with the atlas, and, in part, by the articulations of the cervical vertebrae. The motion of rotation (which cannot be forced beyond the fourth of a circle



Diameters of foetal head. 1-2. Occipito-frontal. 3-4. Occipito-mental. 5-6. Cervico-bregmatic (or vertical). 7-8. Fronto-mental.

without danger) is provided for chiefly by the articulation of the atlas with the axis, and partly by the joints between the other cervical vertebrae. The articulation of the atlas with the cranium, being nearer the occipital than the opposite pole of the head, is of importance in promoting "flexion" during labor, as will be explained further on. (See Chapter XIV.)

with the kind of presentation, and consequently the cranial diameters will vary accordingly.

Again, let it be remembered that the object of measuring any particular diameter is to get the dimension of the head in that one direction, and, while authorities constantly differ as to the exact points on the skull at which the extremities of their diameters are to be placed, the practical principle in measuring crania may be illustrated thus: The occipito-mental diameter *starts* at the point of the chin, and ends at some opposite point on the median line of the occiput *furthest removed from the point of starting*; the occipito-frontal *starts* at the most anteriorly projecting part of the median line of the forehead, and ends at a point on the median line of the occiput *furthest removed from the point of starting*; and so of the other diameters.

CHAPTER III.

EXTERNAL ORGANS OF GENERATION.

THE structures generally included in the external generative organs of the female are : the mons veneris, labia majora, labia minora (nymphæ), clitoris, vestibule, urethra and its meatus, the fossa navicularis, hymen, and carunculæ myrtiformes. The term "vulva" is generally used to express all of the genital structures just mentioned except the mons veneris. The term "*pudenda*" has a similar meaning.

The Mons Veneris (*Mont de Venus*).—The mons veneris is a cushion of adipose, cellular, and fibrous tissue, situated upon the front of the symphysis and horizontal rami of the pubes. Its thickness varies with the obesity of the individual, and its prominence differs according to the degree of projection of the pubes. After puberty it is covered with hair, and is abundantly supplied with sweat and sebaceous glands. Its function is not positively known. It possibly serves the purpose of a brow, in preventing irritating secretions from the skin trickling into the vulvar fissure.

The Labia Majora.—The labia majora, called also "labia externa" and "labia pudendi," are the lips of the genital fissure, placed side by side in an antero-posterior direction. They begin at the lower part of the mons veneris (as if by a bifurcation of that structure), which is their thickest part, and pass at first downward, then horizontally backward, becoming thinner in their course, and join each other at a point about one inch in front of the anus. Their point of junction in front is called the *anterior commissure*, and their point of apposition¹ behind, the *posterior commissure*.

They have two surfaces, an *external* surface covered with ordinary skin, abundantly supplied with hair follicles and

¹ The labia do not unite posteriorly *at an angle*, but running side by side, close to each other, the vulvar fissure terminates in a sort of horizontal "gutter" continuous with the perineum; hence I have applied the term "apposition" instead of "junction" to the posterior union.

sebaceous glands, and an *internal* surface, also of skin, but so smooth as to be almost indistinguishable from a mucous membrane. The transition from skin to mucous membrane really takes place in the labia minora, hence the covering of these latter organs is described by some writers as skin, by others as mucous membrane.

Under the skin of the labia majora is a thin layer of unstriated muscular fibres—the “woman’s dartos”—and beneath this, embedded in adipose and connective tissue, a pear-shaped sac, the narrow neck of which is continuous with the external inguinal ring. It is known as “Broca’s pouch”; contains fat and connective tissue, and occasionally, in young subjects, a process of peritoneum, homologous with the processus vaginalis of the male, known as the “canal of Nuck.” This canal usually becomes obliterated, but may sometimes persist and become the seat of hernia. It follows the course of the round ligament of the uterus, some of the fibres of which terminate in the labia majora.

The Fossa Navicularis.—Just before the labia come together posteriorly they are united by a transverse fold of mucous membrane (which somewhat resembles the web of skin between the thumb and finger) called the *fourchette* (or frenulum pudendi), and the little, depressed space between this and the posterior commissure is the *fossa navicularis*. It is generally obliterated after labor by rupture of the fourchette.

The Labia Minora.—The labia minora, or nymphæ, are thick, double folds of mucous membrane, about one inch and a half long, which begin by gradually projecting from the inner surface of the labia majora, midway between the two commissures. They then pass forward until reaching the clitoris, when they split horizontally into two folds. The upper folds pass above the clitoris, and, joining in the median line, contribute to form the *prepuce* of that organ, while the lower ones join underneath, forming its *frenum*. The nymphæ are covered with tessellated epithelium; they contain connective and muscular tissue, vascular papillæ, and sebaceous glands. They are very vascular, also erectile, and secrete an odorous sebaceous mucus which lubricates their surface and prevents adhesive union. Their function is not certainly known.

The Clitoris.—The clitoris is a small, erectile body, about one inch in length, placed just inside the vulvar fissure, half

an inch behind the anterior commissure. It is composed of two corpora cavernosa, which are united in the median line and end anteriorly in the glans clitoridis, but separate from each other posteriorly to form the two crura, which are attached to the rami of the pubes and ischia. It is considered to be the analogue of the penis, but differs from this organ in having no corpus spongiosum or urethral canal. The vascular bulbs of the vestibule and the intermediate plexus of veins uniting them on each side with the vessels of the clitoris, would, if united in the median line, represent the corpus spongiosum of the penis and bulb of the male urethra. The clitoris has two erector muscles; it is abundantly supplied with vessels and nerves, and constitutes the principal seat of sexual sensation. It is secured to the pubis by a suspensory ligament.

The Vestibule.—The vestibule is a triangular surface of mucous membrane whose base is the anterior margin of the vaginal orifice; its apex terminates at the clitoris, and its two sides are bounded by the nymphæ. It is of little importance except as a guide for finding the *meatus urinarius*, placed near its lower margin.

On each side of the orifice of the vagina, enclosed in a thin layer of fibrous tissue, under the labia majora, is a spongy, oblong mass of small, convoluted veins, which, when distended during sexual excitement, assumes, in its entirety, the form of a filled leech or of a diminutive banana. These are called the *bulbi vestibuli*, sometimes the *vaginal bulbs*. Their veins are continuous with those of the clitoris and vagina.

The Female Urethra.—The female urethra is one inch and a half in length; is larger than that of the male, and more easily dilatable; it begins at the meatus, which is situated immediately below the rim of the pubic arch, and passes backward, curving a little upward, to the neck of the bladder. It is composed of a mucous, muscular, and vascular coat. About one-eighth of an inch within the meatus are the openings of two tubular glands, just large enough to admit a No. 1 probe of the French scale. These glandular tubules run parallel with the long axis of the urethra, beneath the mucous membrane, in the muscular wall. They vary from three-eighths to three-fourths of an inch in length.

The Hymen.—The hymen is a crescentic-shaped fold of mucous membrane whose convex border is attached to and

continuous with the posterior wall of the vaginal orifice, just inside the fourchette. Its sides then run upward to terminate in the horns of the crescent, which last are united by its anterior concave border. It varies in form in different women. Sometimes the horns of the crescent, instead of coming to a point, are continued as a narrow band to the anterior vaginal wall, where the ends join each other, leaving a circular or oval opening in the centre ("annular hymen"). Occasionally it covers the orifice of the vagina entirely ("imperforate hymen"), or it may present a number of very small openings ("cribriform hymen"). It also varies in thickness and strength. It is usually ruptured by the first act of *coitus*, though not always, and may be torn by other causes, so that it is by no means so sure a sign of "virginity" as was formerly supposed. Sometimes the inner border of the hymen has a fringed appearance, resembling the end of a Fallopian tube (hence called "hymen fimbriatus"): this might be mistaken for a normally ruptured hymen. Moreover, it is sometimes absent altogether.

The Myrtiform Caruncles (Carunculæ Myrtiformes).—Formerly these were said to be shrivelled, projecting remains of the ruptured hymen; subsequently they were considered to be vascular, membranous prominences placed immediately behind the hymen, and quite independent of it. More recently they have been ascribed to childbirth, pressure of the child's head during labor causing necrosis and sloughing of the previously torn hymen, of which, therefore, these so-called caruncles are the only visible remains. This last view is probably correct, and explains why the caruncles are often absent.

CHAPTER IV.

INTERNAL ORGANS OF GENERATION.

THE internal organs of generation are the vagina, uterus, Fallopian tubes, and ovaries.

THE VAGINA.

The vagina is a membranous canal extending from the vulva to the uterus, hence sometimes called the "vulvo-uterine canal."

It is made up of a mucous membrane (covered with pavement epithelium) continuous with that of the vulva and uterus. Outside the mucous coat is a thin, muscular layer continuous with the uterine muscles, whose fibres run, some longitudinally, some in a circular direction, and others obliquely. The muscular coat becomes thicker during pregnancy. It is extremely vascular, its vessels being so disposed as to constitute an erectile tissue, especially toward the vulva. Cellular and fibrous tissues also enter into the composition of the vaginal wall.

Underneath the epithelium of the mucous membrane are a large number of vascular papillæ. Along the median line of the anterior and posterior vaginal walls there is a vertical ridge in the mucous membrane (the "anterior and posterior columns" of the vagina), and diverging from these, laterally, the mucous coat is thrown into transverse ridges which admit of dilatation of the canal during labor.

Its posterior wall is about three and a half inches long, its anterior wall about three inches. Its diameter is a little above an inch. At rest, the anterior and posterior walls are in contact with each other.

With regard to the exact situation and direction of the vagina, the descriptions and illustrative plates of anatomists differ widely. Roughly speaking, according to Leishman,

"it lies in the axis of the pelvis, but its axis is placed anterior to the pelvic outlet, so that its lower portion is curved forward."

Its attachments to adjoining organs are as follows: the posterior wall is connected by its *middle three-fifths* with the rectum, the united walls constituting the recto-vaginal septum; its *lower fifth* is separated from the rectum, and is in contact with the perineal body; while its *upper fifth* is in contact with the fold of peritoneum which descends behind the womb to form Douglas's *cul-de-sac*. Its anterior wall is united by connective tissue with the posterior walls of the bladder and urethra, constituting, respectively, the vesico-vaginal and urethro-vaginal septa. (See Fig. 7, page 45.)

The upper extremity of the vaginal cylinder surrounds and is attached to the neck of the uterus: it is called the *fornix*.

On each side of the orifice of the vagina are the *bulbi vestibuli* already described. Immediately beneath and behind the posterior round extremity of this bulb of the vestibule is placed, on each side, the *vulvo-vaginal gland* (analogue of Cowper's gland in the male, and variously called the gland of Huguier and of Bartholin). It is a conglomerate gland, varying in size from a horse-bean to an almond, and secretes, during sexual excitement, an exceedingly viscid mucus, which is discharged from the orifice of the gland-duct into the fossa navicularis.

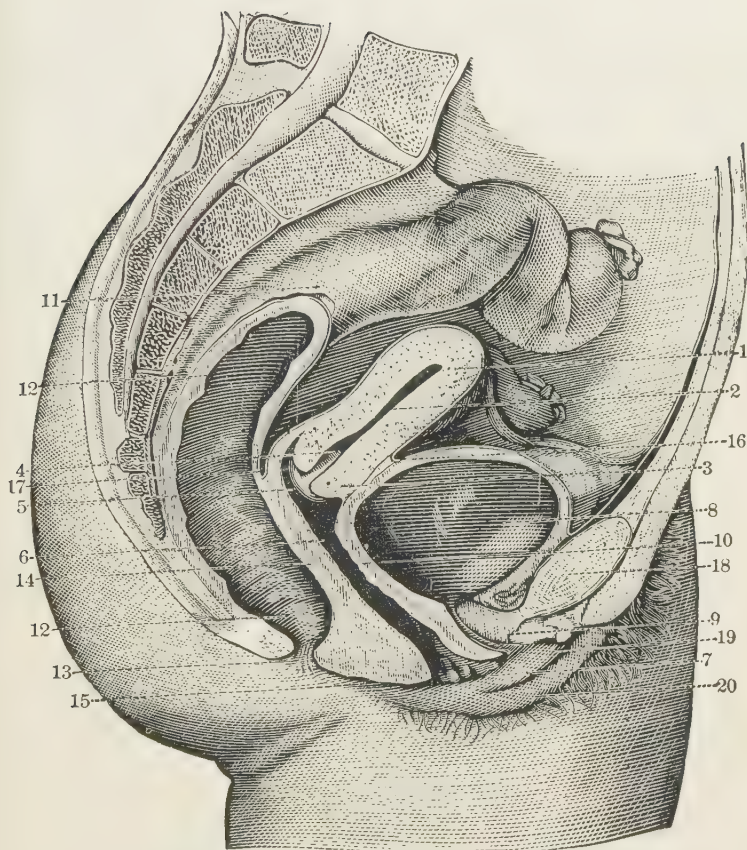
The vagina is abundantly supplied with nerves, especially toward its orifice, where it is endowed with a peculiar sensibility. Its arterial supply is derived from the uterine, hypogastric, vesical, and pudendal arteries; and its numerous venous plexuses, continuous with those of the vulva, clitoris, and uterus, terminate in the hypogastric veins. The vaginal veins have no valves.

THE UTERUS.

The uterus is a thick-walled hollow organ, in the form of a truncated cone, slightly flattened antero-posteriorly, situated in the middle of the pelvic cavity, its upper end being a little below the plane of the superior strait. The bladder is in front of it, the rectum behind, and the vagina below it.

The small intestine rests upon it from above. In Fig. 7 the

FIG. 7.



Female generative organs, as seen in longitudinal section through the median line of the body. 1. Body of uterus. 2. Cavity of body. 3. Cervix uteri. 4. Cavity of cervix. 5. Os uteri. 6. Cavity of vagina. 7. Vaginal orifice. 8. Bladder. 9. Urethra. 10. Vesico-vaginal septum. 11. Rectum. 12. Cavity of rectum. 13. Anus. 14. Recto-vaginal septum. 15. Perineum. 16. Vesico-uterine cul-de-sac. 17. Recto-vaginal cul-de-sac, or cul-de-sac of Douglas. 18. Symphysis pubis. 19. Nympha. 20. Labium majus. (From BARNES, after TARNIER AND SAPPEY.)

relative position of the uterus is shown with the bladder and rectum *distended*. When these organs are *empty*, the relations

of the parts are more exactly represented, as in Fig. 8. The uterus has *three coats*: (1) a serous coat (peritoneum) on the outside, (2) a muscular coat, which gives thickness and solidity to the uterine walls, and is composed of non-striated muscular

FIG. 8.



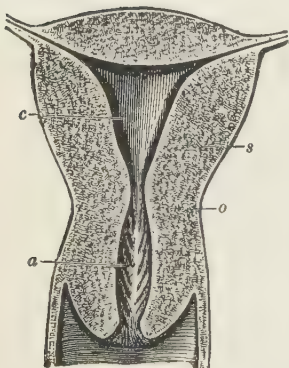
Relative position of pelvic organs when bladder and rectum are empty.
(After DICKINSON.)

fibres arranged in layers, having different directions, circularly, longitudinally, and spirally, which are closely adherent to and decussate with each other; (3) a mucous lining continuous with that of the vagina and Fallopian tubes, and covered with ciliated, columnar epithelium. When a new mucous membrane begins to form in the uterus after menstruation the cells are *without* cilia; but the mature cells *are* ciliated, which accounts for some observers asserting that these cells are ciliated and others that they are not.

That portion of the neck of the uterus which projects into the top of the vagina is covered externally with pavement epithelium. This last joins the columnar epithelium of the interior of the uterus just within the external os uteri.

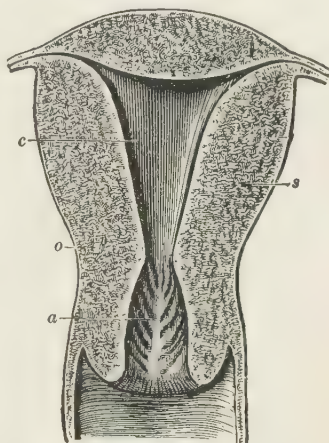
In length (counting the thickness of its upper wall) it is (roughly) about 3 inches; the length of its *cavity*, from the external os to the top of the fundus (*not* including thickness of upper wall), is $2\frac{1}{2}$ inches; its width, transversely across its widest upper part, is $1\frac{1}{2}$ inches; and its greatest antero-posterior

FIG. 9.



Section of the uterus before childbirth. *a*. Cavity of cervix. *c*. Cavity of body. *o*. Os internum. *s*. Uterine wall. (From BARNES, after TARNIER.)

FIG. 10.



Section of uterus after childbirth. The letters have the same meaning as in Fig. 9. (From BARNES, after TARNIER.)

thickness 1 inch. At the end of pregnancy it attains the size of a foot or more in length, and 8 or 10 inches transversely.

It is divided by anatomists into fundus, body, and neck. The *fundus* is all that rounded portion placed above a horizontal line drawn through the angles where the Fallopian tubes open into the womb; the *body* is all that portion between the fundus and the neck; and the *neck* is all that part below a line drawn horizontally through the organ at the level of the internal os uteri.

Its cavity is divided into the cavity of the body and the cavity of the neck. That of the body is triangular and flattened antero-posteriorly; it has three openings, those of the two Fallopian tubes above and that of the os internum below. The cavity of the neck is barrel-shaped or fusiform, and comparatively narrow; it is constricted above by the internal os, that separates it from the cavity of the body, and grows narrow again at its termination in the external os uteri. After childbirth the constrictions of the internal and external os are less marked. (See Figs. 9 and 10, page 47.)

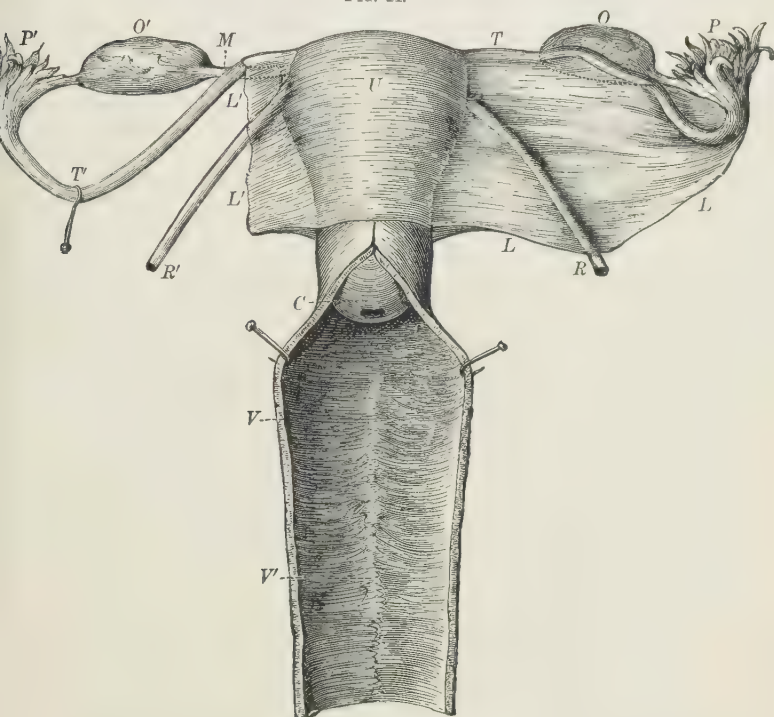
Microscopic Structure of the Uterine Mucous Membrane.—It is composed of mucous follicles ("utricular glands") placed perpendicularly to the internal surface of the womb. Their mouths open into the uterine cavity, and they terminate by rounded, bulbous extremities (some of which are bifurcated) upon the muscular coat. The follicles are lined with columnar epithelium; and some idea may be formed of their size ($\frac{1}{30}$ th of a *line* in diameter) by remembering that there are about ten thousand of them in the mucous membrane of the *cavity of the neck* alone.

Broad Ligaments of the Uterus.—These are simply folds of peritoneum covering the external surface of the womb. Let us imagine a line drawn across the outside of the top of the fundus and prolonged transversely until it reach the sides of the pelvis. Beginning at this imaginary line a broad layer of peritoneum passes down over the *anterior* wall of the womb to the level of a point midway between the internal and external os, when it turns up and is reflected over the posterior wall of the bladder: this is the *anterior* broad ligament. A similar fold passes down over the posterior wall of the womb, going low enough to cover the upper one-fifth of the posterior *vaginal* wall (as already explained), when it turns up and is reflected over the anterior wall of the rectum: this is the *posterior* broad ligament. Thus the uterus, with (and between) its two broad ligaments, forms a sort of transverse partition to the pelvic cavity: the bladder, urethra, etc., being in the front compartment, and the rectum in the back one. The lateral borders of this double ligamentous curtain are attached to the sides of the pelvis, and hence these ligaments are sometimes called "right" and "left," instead of "anterior" and "posterior," as above.

Other Ligaments of the Uterus:

First. The *round ligaments*, which are fibro-muscular cords, $4\frac{1}{2}$ inches long. They begin near the superior angles of the

FIG. 11.



Anterior view of internal generative organs, ligaments, etc. Part of the broad ligament on the right side has been removed, and the anterior vaginal wall slit up by a central incision. *C.* Cervix uteri. *L.* Broad ligament of left side. *L'.* Broad ligament of right side. *M.* Utero-ovarian ligament. *O.* Left ovary. *O'.* Right ovary. *P.* Fimbriated end of Fallopian tube. *R.* Round ligament of left side. *R'.* Round ligament of right side. *T.* Left oviduct. *T'.* Right oviduct pulled down to show ovary. *U.* Uterus. *V.* Vagina. *V'.* Posterior column of vagina.

womb, and pass between the two folds of the broad ligaments, successively outward, forward, and then inward, to the inter-

nal inguinal ring, and through the inguinal canal, their terminal fibres being lost in the *mons veneris* and *labia majora*.

Second. The *vesico-uterine* ligaments: semilunar-shaped folds of peritoneum passing from the lower part of the body of the uterus to the fundus of the bladder.

Third. The *utero-sacral* ligaments: crescentic-shaped folds of peritoneum passing from the lower part of the body of the uterus to be inserted into the third and fourth sacral vertebrae.

FIG. 12.



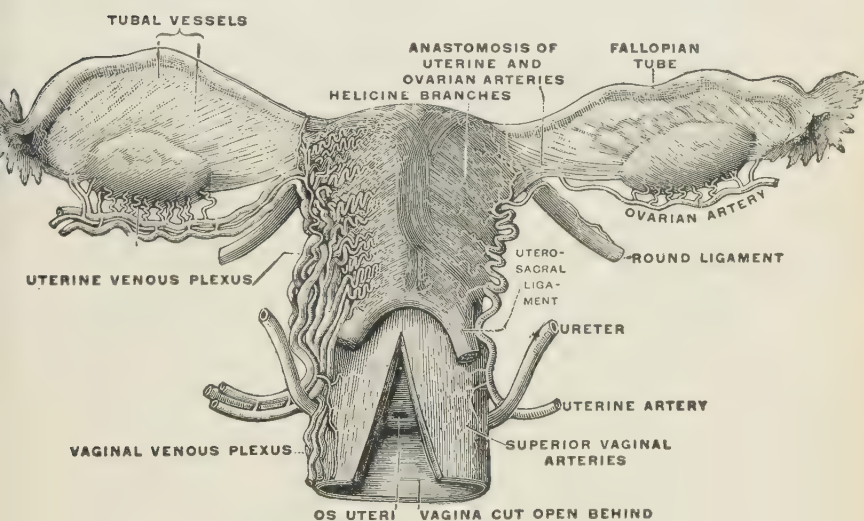
Generative organs seen from above. M. Pubes. A, A (In front). Remainder of hypogastric arteries. A, A (Behind). Spermatic vessels and nerves. B. Bladder. L, L. Round ligaments. U. Fundus of uterus. T, T. Fallopian tubes. O, O. Ovaries. R. Rectum. G. Right ureter resting on the psoas muscle. C. Utero-sacral ligaments. V. Last lumbar vertebra.

Fourth. There is still another short cord, containing many smooth muscular fibres, extending from near the upper angle of the uterus to the inner extremity of the ovary. It is about one inch in length, and is called the *utero-ovarian* ligament—sometimes the “*ligament of the ovary*.” All the ligaments of the uterus contain some muscular tissue, which is increased during pregnancy. (See Fig. 11, page 49.)

The relative position of the uterus and its ligaments, with adjacent organs, when seen from above, is shown in Fig. 12.

Arteries of the Womb.—The *uterine artery* (one on each side) is given off from the anterior branch of the internal iliac. It descends behind the peritoneum to the fornix vaginae, where its pulsation may be felt with the finger during pregnancy, and then ascends between the anterior and posterior folds of the broad ligament, along the side of the cervix and corpus uteri (to both of which it gives off many deeply penetrating branches), and, finally, its main trunk becomes directly continuous with the ovarian artery.

FIG. 13.



Blood supply of uterus. (After TESTUT.)

The *ovarian artery* (one on each side, corresponding with the spermatic artery of the male) is given off from the aorta $2\frac{1}{2}$ inches above its bifurcation. It descends into the pelvic cavity, and then ascends between the two folds of the broad ligament to the Fallopian tube, ovary, and fundus uteri, and terminates by anastomosis with the uterine artery just described.

At the junction of the body and cervix uteri is a circumflex branch which unites the arteries of the two sides, and which,

when cut during surgical operations, bleeds profusely. The arterial branches in the uterine walls are remarkable for their numerous anastomoses and spiral course (hence called *helicine* arteries), the latter quality providing—it is supposed—for their longitudinal extension during pregnancy, a supposition that is very materially weakened by the fact that the arteries are *more* tortuous during pregnancy than before. Moreover, the arteries of the ovary present the same spiral course.

Veins of the Uterus.—These begin by small branches continuous with the fine plexus of capillaries into which the uterine *arteries* divide in the internal lining of the organ, and, inosculating freely with each other, unite to form larger veins (always *without valves*) in the substance of the uterine wall, whence they eventually pass out toward the folds of broad ligament, where, joining the ovarian and vaginal veins, a remarkable venous network is formed, known as the "*pampiniform plexus*." (See Fig. 13, page 51.) On each side of the uterus, near its junction with the top of the vagina, the greater number of vessels in this plexus pour their blood into a trunk of considerable size—the internal spermatic vein—which empties on the right side into the vena cava and on the left into the left renal vein.

Nerves.—The nervous supply of the uterus is received chiefly from the sympathetic system—viz., from the hypogastric, renal, spermatic, and aortic plexuses.

There is no longer any doubt that it also receives branches from the cerebro-spinal system, derived chiefly from the second, third, and fourth sacral nerves. During pregnancy the nerve-fibres increase in size.

Lymphatics.—The womb is abundantly supplied with lymphatics, and its lymphatic vessels terminate in the pelvic and lumbar glands. It is chiefly through these lymphatic channels that septic matters are taken up from the cavities of the uterus and vagina, transported to other organs, and carried into the blood, thus producing septicæmia.

Functions of the Uterus.—It is the source of the menstrual discharge; it receives spermatic fluid from the male, and the germ-cell—whether impregnated or not—from the female; it provides a place for the fœtus during its development, and is the source of its nutritive supply; and it contracts at full term to expel the child.

During gestation *all* the tissues of the uterus undergo a decided physiological *hypertrophy*. After delivery they go through a sort of gradual physiological *atrophy*—back again to what they were before conception. The enlarged muscles especially undergo fatty degeneration and absorption—called “*involution*,” in contradistinction to “*evolution*” or development. The process of involution requires a month or six weeks for its completion, sometimes longer.

Mobility of the Uterus.—The womb in its normal condition is not fixed or adherent to any part of the skeleton, but enjoys considerable mobility; it is simply suspended or hung in the pelvic cavity by the tent-like aprons of peritoneum and other ligaments attached to it, as well as by its nerves, blood-vessels, and vaginal attachments. A full bladder pushes it backward; a distended rectum, forward. It changes its position, by gravity, as the female changes her posture. Viewed through a speculum, the vaginal part of its cervix may be seen to rise and fall with every motion of the diaphragm during respiration—an observation becoming still more apparent during the violent diaphragmatic motions that attend laughing, coughing, etc. Forcible injection of the uterine arteries after death causes the uterus to rise in the pelvis and execute a movement resembling that performed by the penis during erection, which leads to the supposition—difficult of proof—that this actually takes place during life under venereal excitement.

FALLOPIAN TUBES.

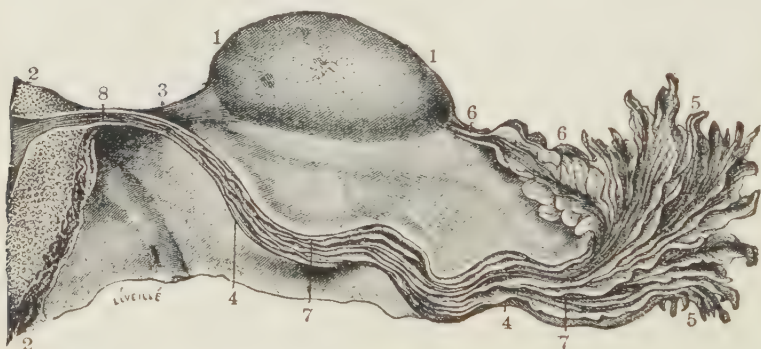
Given off from the uterus, at each of its superior angles, is a tube whose canal is continuous with the uterine cavity. These are the Fallopian tubes (sometimes called “*oviducts*”).

Each tube is about four inches long; near the uterus its diameter ($\frac{2}{5}$ of an inch) will just admit a bristle, but increases in size in its course from the womb toward the free distal end of the tube, where it is as large as a goose-quill. The tube passes from the uterus in a somewhat tortuous course, between the folds and along the upper margin of the broad ligament, toward the side of the pelvis, and terminates in a dilated, trumpet-shaped extremity, the free margin of which is, as it were, frayed out into a number of fringe-like processes called “*fimbriæ*”; one of these, longer than the rest, is attached to

the outer extremity of the ovary. Some of the fringed processes are continued as thin, leaf-like, longitudinal folds of mucous membrane into the dilated end of the tube, which grow narrower as they approach its uterine end, as shown in Fig. 14.

Like the uterus, the Fallopian tubes are composed of three coats: 1. A *serous* (peritoneal) coat on the outside; 2. A *muscular* coat composed of two layers, viz., circular fibres (internally) and longitudinal ones (externally); 3. A *mucous* coat continuous with that of the uterus and lined with ciliated, columnar epithelium. At the distal end of the tube the mucous

FIG. 14.



The ovary and oviduct. 1, 1. Ovary. 2, 2. Part of uterus. 3. Ovarian ligament. 4, 4. Oviduct, its wall opened by a longitudinal incision to show the longitudinal folds of its lining membrane. 5, 5. Pavilion, from internal surface. 6, 6. Fimbria attached to the ovary or tubo-ovarian ligament. 7, 7. Longitudinal folds. 8. Internal end of the oviduct.

coat is continuous with the peritoneum, and furnishes the only instance in the body where a serous and a mucous membrane are thus joined.

Functions of the Fallopian Tube.—It conveys spermatie fluid from the uterus to the ovary and conducts the germ-cell from the ovary to the uterus. When the ovule (germ-cell) is about to be discharged from the ovisac, the fimbriae of the tube grasp the ovary, so as to promote the safe entrance of the diminutive germ-cell into the trumpet-shaped mouth of the

tube, whence it is conveyed, by peristaltic motion of the canal, into the uterus; this transmission of the germ is also assisted by the cilia of the epithelium, which wave toward the womb. The waving of the cilia is said also to produce a current, toward the tube, of the fluid covering the inner surface of the peritoneum near the fimbriated entrance, so that the ovule, when not at once received by the tube, may passively float into it afterward upon this moving fluid.

FIG. 15.



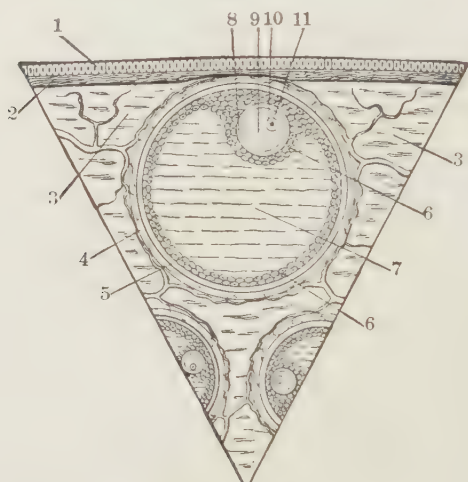
Relations of ovary with uterus and Fallopian tube. The two lines inclose a V-shaped bit of the ovary, which is represented, largely magnified, in the next figure. Both figures are, of course, diagrammatic.

THE OVARIES.

They are two in number (rarely three), and are placed one on each side of the womb, behind and below the Fallopian tubes. Formerly they were thought to be situated between the anterior and posterior folds of the broad ligament. This is incorrect. The ovary is really set "in a hole in the posterior layer of the broad ligament, as a diamond is fastened to a ring." The part projecting posteriorly, above and beyond

the surrounding margin of broad ligament (as the diamond projects above its setting of gold), is therefore devoid of any peritoneal covering, the free surface thus exposed being the columnar epithelial layer of the ovary itself, as shown in Fig. 14, page 54, where a distinct line indicates the transition

FIG. 16.



Triangular bit of ovarian stroma cut from ovary. Magnified to show Graafian follicle and ovule. 1. Epithelial covering of ovary. 2. Tunica albuginea (fibrous). 3, 3. Different parts of stroma. 4. Graafian follicle (tunica fibrosa). 5. Graafian vesicle or ovisac. 6, 6. Tunica granulosa. 7. Liquor folliculi. 8. Vitelline membrane, or zona pellucida. 9. Granular vitellus, or yolk. 10. Germinal vesicle. 11. Germinal spot.

from peritoneum to ovarian epithelium.¹ The ovary is approximately almond-shaped, hence it has two ends, one of which is connected with the angle of the uterus by the fibro-muscular "ligament of the ovary," while the other is joined to the trumpet-shaped end of the Fallopian tube by one of the prolonged fimbria, known as the tubo-ovarian ligament, or *fimbria ovarica*. The ovarian bloodvessels pass up between the

¹ In Fig. 14 the whole ovary is represented pushed up out of place. If pushed down again to its normal position, it would be *below* the Fallopian tube, as shown diagrammatically in Fig. 15.

two folds of broad ligament and enter the organ in a little depression called the *hilum*. Each ovary is about one inch and a half in length, three-quarters of an inch wide, and one-third of an inch thick. Weight, one or two drachms.

Its *function* is ovulation—that is to say, the production, development, maturation, and discharge of ovules. Hence the ovaries are the essential organs of generation in the female, as the testicles are in the male. (Fig. 15, page 55, shows relations of ovary with uterus and Fallopian tube. A triangular bit of ovarian stroma, showing ovum magnified, is seen in Fig. 16, page 56).

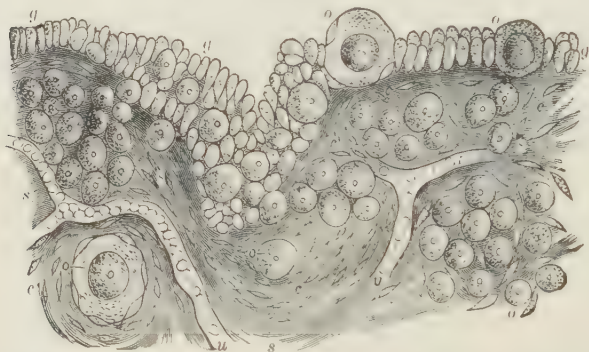
Structure of the Ovary.—The ovary is covered externally with a layer of columnar epithelium, the cells being like those lining the Fallopian tube, except that the ovarian epithelium is *unciliated*. This surface-epithelium is sometimes called “germinal epithelium,” since some of its cells become, during fetal life, deeply embedded below the surface, in the solid substance of the ovary, and thus constitute ovules.

Immediately beneath the external covering of epithelium is a thick coat of white, fibrous tissue, the *tunica albuginea*. Inside this last we find the solid substance of the ovarian body (the kernel of the ovarian nut, so to speak)—the *stroma*—composed for the most part of fibrous and muscular tissue, and traversed by numerous bloodvessels.

Dotted about in various parts of the stroma are little, round cavities, called “Graafian *follicles*.” The wall of these globular follicular cavities is made up of the stroma substance itself, being in fact composed of a dense layer of the stroma’s connective or fibrous tissue, and is therefore sometimes called “*tunica fibrosa*.” It is immediately surrounded on all parts of its periphery with an elaborate network of capillary bloodvessels. Fitting close inside and completely filling the “Graafian follicle” is the “Graafian *vesicle*,” or “*ovisac*,” sometimes termed, in contradistinction to the tunica fibrosa, the “*tunica propria*.” Loosely adherent to the inside of the ovisac all around is a granular layer of epithelial cells, the “*tunica granulosa*.” Inside this is the “*liquor folliculi*” (or fluid contents of the ovisac), in which floats the *human egg*, or *ovule*. It is only a yolk; there is no white to it, so that the next membrane we have to encounter is the *zona pellucida*, or *external* membrane of the egg, while next inside of this is the

internal or vitelline membrane; between these two is a little space occupied by a fluid, called the peri-vitelline space. The egg embraced by the internal or vitelline membrane floats in the fluid of the peri-vitelline space within the zona pellucida. Embedded in the substance of the yolk is the "*germinal vesicle*," and inside that the "*germinal spot*." Besides the tunica granulosa covering the *inside* of the ovisac, a reflected layer of it is disposed all around the *outside* of the zona pellucida. At birth it is said each human ovary really contains

FIG. 17.

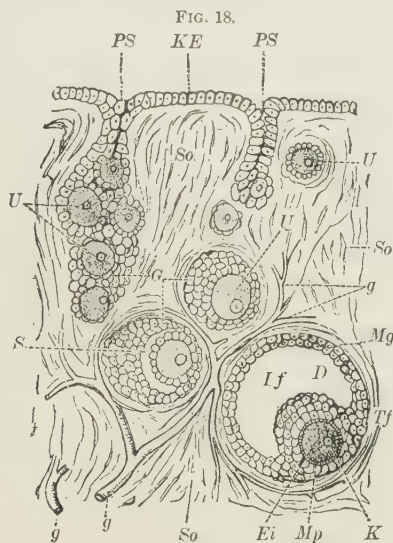


Vertical section through ovary of human fetus. *g. g.* Germ epithelium, with *o, o,* developing ovules in it. *s, s.* Ovarian stroma containing *c, c,* fusiform connective-tissue corpuscles. *u, v.* Capillary bloodvessels. In the centre of upper surface of figure an involution of the germ epithelium is shown; and at the lower left side an isolated primordial ovule, with connective-tissue cells ranging themselves round it. (From PLAYFAIR, after FOULIS.)

about 30,000 Graafian follicles, with their contents; but only the few that are approaching maturity are large enough to be seen with the naked eye. The ovules are therefore formed, for the most part, before birth, though their formation is thought to continue in some instances two or three years later. Early in fetal life the "primordial ova" were simply enlarged epithelium cells—germ epithelium—upon the external surface of the ovary. The way in which they become, later on, isolated ovules buried in the ovarian stroma, is as follows: Cylindrical inflexions of the epithelial covering of the ovary turn in and dip down into the substance of the stroma, forming a sort of

tubule (like the follicle of a mucous membrane). These are known as "egg-cords," or Pflüger's tubes. The beginning of such a folding-in of the germinal epithelium is shown in Fig. 17.

While these inflections of germinal epithelium dip down into the ovarian stroma, the connective tissue of the stroma itself grows up around them, and finally unites, cutting off the



Section through part of a mammalian ovary (after WIEDERSHEIM). *KE*. Germinal epithelium. *PS*. Inflected surface of epithelium, forming tubule or egg-cord. *U*. Primitive ova. *G*. Investing cells. *K*. Germinal vesicle. *S*. Follicular cavity arising in one of the older follicles. *If*. Follicular cavity more enlarged. *Ei*. Nearly mature ovum which has developed around it the zona pellucida. *Mp*. *Mg*. Membrana granulosa. *D*. Proliferous disk. *So*. Ovarian stroma. *Tf*. Graafian follicle. *g*. bloodvessels.

necks of the tubules, and thus burying them in the substance of the ovary, where they become ovisacs. The several stages of the process are shown in Fig. 18.

The way in which the ovule (egg, germ-cell) gets out of the ovary is as follows: As the Graafian follicle reaches maturity it approaches the surface and begins to cause a protuberance

(like a little boil) upon the outside of the ovary. Eventually the epithelial external coat, the tunica albuginea, the wall of the Graafian follicle (tunica fibrosa, and the wall of the Graafian vesicle (or ovisac), all burst at the same point, and out comes the vitelline membrane, safe and whole, with its contents, and clinging around it a loose, irregular mass of the "tunica granulosa," called the "*proligerous disk*."

FIG. 19.



Section of ovary, showing corpus luteum three weeks after menstruation.
(After DALTON.)

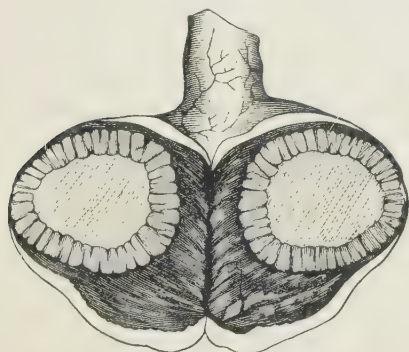
At the moment of rupture of the follicle, or shortly afterward, the ovule is received by the Fallopian tube and after some days is conveyed to the uterus.

THE CORPUS LUTEUM.

After discharge of the ovule, together with the liquor folliculi and that part of the tunica granulosa clinging to the ovule, the empty, deserted ovisac fills up with a clot of blood, to which are subsequently added newly proliferated cells of the membrana granulosa; wandering white corpuscles from the blood; and a "vitellus-like substance" of a *yellow* color. The white blood-corpuscles accumulating near the wall of the vesicle press the remaining contents toward the centre of the cavity, while vascular papillae project on all sides

toward the centre. The larger vessels indenting the yellow mass impart to its exterior a folded appearance, formerly ascribed to convolutions in the wall of the ovisac. Eventually the contents of the sac are absorbed, and the follicle shrivels and contracts into an insignificant cicatrix or dimple. The yellow color of the contents of the ovisac has caused the site of the discharged ovule to be called "*corpus luteum*"—yellow body. Corpora lutea are of two kinds, "true" and "false." If the ovule be impregnated, a *true* corpus luteum

FIG. 20.



Corpus luteum of the fourth month of pregnancy. (After DALTON.)

FIG. 21.



Corpus luteum of pregnancy at term. (After DALTON.)

is developed; if impregnation have not taken place, there results a *false* corpus luteum. The special (chief) differences between the two are as follows: 1st. The false corpus luteum increases in size for three weeks only (see Fig. 19); the true one continues to grow for about four months (see Fig. 20). 2d. After three weeks the false corpus luteum declines rapidly in size, and is reduced to a cicatricial dimple at the end of two months; while the true one, having grown so large as to occupy the greater part of the ovary by the fourth or fifth month, remains about the same size during the fifth and sixth months, then gradually declines during the seventh, eighth, and ninth months; but it is not reduced to an insignificant cicatrix until one or two months after delivery.

3d. A true corpus luteum is single ; a false one will be accompanied (either in the same or the opposite ovary) by the visibly evident remains of its predecessor. 4th. The cicatrix resulting from a true corpus luteum is more distinctly stellate than the cicatrix of a false one.

FIG. 22.



aa. Parovarium. *b.* Remains of the uppermost tubes of the Wolffian body. *c.* Middle set of tubes forming parovarium. *d.* Lower atrophied tubes. *e.* Atrophied remains of Wolffian duct or Gartner's canal. *f.* The terminal bulb or hydatid of the Wolffian duct. *h.* The Fallopian tube. *i.* Hydatid of Morgagni. *l.* Ovary.

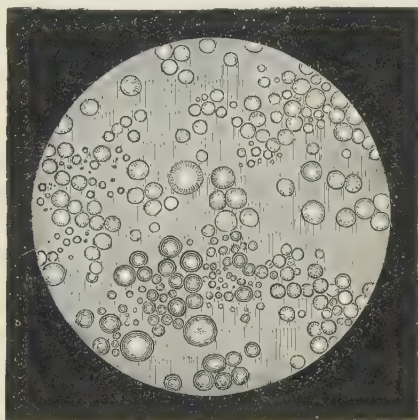
THE PAROVARIIUM.

The parovarium (sometimes called the *organ of Rosenmüller*) is the remains of the *Wolffian body* of fetal life, and corresponds to the epididymis of the male. Placed in the posterior fold of the broad ligament, where it may be seen by holding up the latter and looking through it by transmitted light, it consists of from ten to twenty tortuous tubes arranged in a pyramidal form (like the ribs of a fan), the base of the pyramid, surmounted by a transverse tube with which the others communicate, being toward the Fallopian tube, its apex lost on the surface of the ovary. The parovarium has no excretory duct and no known function. It is chiefly of interest in that the accumulation of fluid in its tubes is often the beginning of cystic tumor of the broad ligament (see Fig. 22).

THE MAMMARY GLANDS.

The mammary glands, whose function it is to secrete milk for the sustenance of the child after birth, properly belong to the reproductive system. In shape the gland is a flat, sometimes very flat, hemisphere, its base resting upon the pectoralis major muscle, between the third and sixth ribs. By cutting a large orange transversely through its equator each half would give an approximate idea of the shape of the gland, and on the cut surface will be seen radiating trabeculæ, between which

FIG. 23.

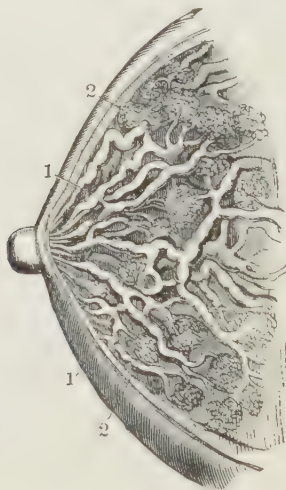


Globules of healthy milk; fourteen months' lactation.

the pulp of the fruit is placed, that fairly resemble the radiating trabeculæ of fibrous tissue, fifteen or twenty in number, between which the so-called "lobes" of the secreting substance of the mammary gland are contained, and which are continuous with the circumferential fibrous capsule of the organ. The lobes are made up of lobules, and the lobules of terminal culs-de-sacs (acini) lined with columnar epithelium. Each acinus empties its secretion (the milk being formed by desquamation, fatty degeneration, and rupture of the epithelial cells) through a little duct, which unites with others to form a larger duct for the lobule, and the lobular ducts unite

to terminate in a still larger duct for each lobe, termed the *galactophorous duct*. The galactophorous ducts, fifteen or twenty in number, one for each lobe, converge toward the nipple, becoming widely dilated as they approach it, but narrowing again as they actually enter it. The main ducts have non-striated muscular fibres in their walls, the contractions of which sometimes cause spurting of the milk from the nipples. (See Fig. 24.)

FIG. 24.



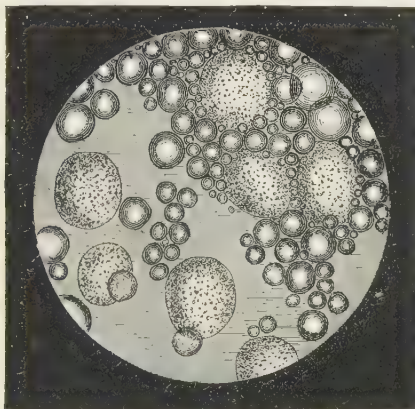
Lactiferous or galactophorous ducts.

Viewing the breast externally, we see the apex of the mammary projection surrounded by a pink disk of skin called the *areola*. From the centre of the areola projects the *nipple*, and beneath the disk is a circular band of muscular fibres, which, in contracting, assists the expulsion of milk.

As already stated, milk is formed by breaking down of the cell wall of the epithelial cells lining the acini of the mammary glands, and liberation of the cell contents, consisting of fatty granules and liquid protoplasm. The secretion thus formed is rendered more fluid by a watery transudation directly

from the bloodvessels. The free fatty granules coalesce and aggregate together, and thus form larger masses called milk-globules, which are still so small as to be microscopic, and constitute a fatty emulsion with the more fluid portion of the milk in which they float. (See Fig. 23, page 63.)

FIG. 25.



Showing colostrum and ordinary milk globules, first day after labor; primipara, aged 19. (After HASSALL.)

During the first day or two of lactation, however, the particles of fat are held together in masses of considerably larger size, having a granular appearance, and called "colostrum corpuseles," as seen in Fig. 25.

The mammary glands receive their blood-supply from the internal mammary and intercostal arteries. Their nerves are derived from the intercostal and thoracic branches of the brachial plexus. They are also abundantly supplied with lymphatic vessels, which open into the axillary glands.

CHAPTER V.

MENSTRUATION AND OVULATION.

MENSTRUATION is a monthly hemorrhage from the uterine cavity.

It is called "*catamenial discharge*," "*menses*," and "*menstrual flow*," or in common parlance the "*monthly sickness*," the "*flowers*," the "*turns*," the "*courses*," the "*periods*"; or the woman is said to be "*unwell*."

We have already defined ovulation to be the development and maturation of ovules in and their discharge from the ovary. What relation has this process to menstruation?

About the time when an ovule is ripe and soon to be discharged, the reproductive organs, especially the ovaries and uterus, receive an extra amount of blood—they become physiologically congested in anticipation of impregnation taking place (for the menstrual period is really analogous with the period of "heat" or "rut"—"oestrus"—in other animals); but in the absence of impregnation the extra blood-supply, which was designed to prepare the organs for the reception and development of an *impregnated* germ, fails of its natural purpose and is discharged in the form of menstruation. Menstruation is therefore dependent upon and more or less coincident with ovulation—this is the "*ovulatory theory*" of menstruation, so called. Objections have been urged against this theory. *First*. It is said the menses have recurred after removal of both ovaries. (Answer. This is extremely exceptional; the removal may have been incomplete; there is sometimes a third ovary;¹ the spayed women used as guards to the harems of Central Asia do not menstruate; finally, the menstrual discharge, having been continued for years, may persist from *habit*, even after the original cause, viz., ovulation, has

¹Small supernumerary ovaries have been found twenty-three times in five hundred bodies. (Garriques, quoting Beigel.)

ceased to recur.) *Second.* It is alleged that women do not allow coitus and become impregnated *at* the menstrual periods, but always *between* the periods, from which it is inferred ovulation is *not* coincident with menstruation. (Answer. The human female, like other animals, is really more liable to impregnation when cohabiting near the menstrual period, and the same greater liability probably obtains *at* the period did not the flow prevent cohabitation; moreover, the union of the germ-cell with the spermatic fluid of the male may take place *at* the ovulatory period from the survival of spermatozoa introduced by coitus a week or more before ovulation; the ovule also may remain after being discharged from the ovary and be impregnated a week or more after menstruation.) *Third.* It is stated that ovules are discharged from the ovary without any accompanying menstrual flow. (Answer. This may be admitted and explained without fatally conflicting with the theory. It is, however, exceptional.) While some recent writers regard the ovulatory theory of menstruation as a thing of the past—of only historic interest—it cannot be thus summarily disposed of at present. True, those who have had large experience in removing the ovaries and Fallopian tubes find perhaps “hundreds of cases” (an *apparently* convincing expression) in which menstruation continued after this mutilation, but *all* these women were so far *abnormal* as to require surgical interference. There are “hundreds of millions” of *normal* women in whom we have every reason to believe the functions of ovulation and menstruation are as intimately related as they were thought to be before the days of modern abdominal surgery. In fact the sexual and reproductive functions are tampered with in so many ways by the usages of civilization, that it may be actually true that really *normal* cases are in the minority, instead of constituting the majority which those who deny the ovulatory theory of menstruation consider to be synonymous with normality. The majority may be *abnormal*. On the whole, the ovulatory theory of menstruation is the best yet propounded, and must be received, at least for the present.

Changes in the Uterine Mucous Membrane at the Menstrual Epochs. — Just before the flow the membrane becomes much thicker, congested, and thrown into shallow folds. Then it undergoes disintegration by fatty degeneration,

and is thrown off with the blood that flows from the opened capillary bloodvessels. There exists some discrepancy of opinion as to *how much* of the mucous membrane is thrown off every month, but no doubt exists as to the fact of its becoming physiologically hypertrophied just before the menses, and of its undergoing a certain degree of fatty atrophy and degeneration during and immediately after the period. Shortly after menstruation a new mucous membrane is already in course of preparation.

Some writers affirm that the ovule discharged at a given menstrual period does not really belong to that period, but to the next subsequent one, that is to say : the menstrual process (decidual degeneration) occurring, *œ. gr.*, at the middle of February, is the breaking up of the decidual membranes prepared for the ovule set free a month before, at the middle of January. This theory, indorsed by high authority, is probably correct.

What Becomes of the Ovule?—When not impregnated it is lost and discharged with the menstrual flow, either before or after its disintegration. It is too small to be seen ; the vitelline membrane is a mere cell, $\frac{1}{120}$ of an inch in diameter, and its contained germinal vesicle measures $\frac{1}{720}$ of an inch ; the germinal spot about $\frac{1}{3000}$. The “vesicle” is the nucleus of the cell ; the “spot” the nucleolus ; the entire egg simply a mass of protoplasm.

The First Menses and Puberty.—*Menstruation* begins at about fourteen or fifteen years of age—the “*age of puberty*,” so called. This period is preceded and attended by what are called the *signs of puberty*. They consist in the development of womanly beauties, physiologically designed to attract the male ; enlargement and growth of hair upon the mons veneris and labia majora ; growth of hair in the axillæ ; enlargement and increased rotundity of the hips and breast ; the vulva is drawn downward and backward, so that in the erect posture no part of it is visible anteriorly, as it is in children ; striking changes also occur in the inclinations and emotional susceptibilities of the woman.

Circumstances modify the age at which the first menstruation takes place : thus, the menses appear earlier in *hot climates*, but the difference between the hottest and coldest climates is only about three years ; the influence of *race*, which remains

potent in spite of climatic changes; *occupation and mode of life*: luxury, stimulants, indolence, hot rooms, pruriency of thought, etc., render the woman precocious, while opposite conditions retard the menses; general robustness of constitution and vigorous health promote the development of menstruation, and it is delayed by feebleness and debility. On the other hand, a very tall woman with large bones and muscles will require more time to complete her growth, and hence the reproductive functions will be belated.

The very rare and unique cases, indisputably authenticated, in which children one or two years old have presented the external anatomical evidences of puberty, and have then menstruated with more or less regularity, and have even become mothers before they were ten years old, are mere medical curiosities—*lusus natura*—of but little import in discussing the physiology of this subject.

Symptoms of menstruation, not always present, are lassitude and depression of spirits, headache, backache, chilliness, weight in hypogastrium and perineum, nausea, neuralgia, hysteria, perhaps slight febrile excitement. They vary in kind and degree in different individuals, and are generally relieved by the flow. The first few periods are apt to be irregular in their recurrence, and the discharge is slight in quantity and composed of mucus with but little blood.

Quantity and Qualities of the Menstrual Discharge.—The *quantity* of discharge, when the function has become regularly “established,” is from one to eight ounces, the average being about five ounces. The duration of the period is from one to eight days, the average being five days, hence average daily quantity during that period, one ounce.

The menstrual blood does not coagulate, owing to admixture with vaginal mucus, which contains acetic acid. If the flow be very profuse, coagulation will occur, because the action of the vaginal mucus is then insufficient to prevent it. Mucus of *any* kind, in sufficient quantity, will prevent coagulation.

The discharge also differs at different parts of the period. Toward the beginning and end of the epoch it contains more mucus and less blood; at the middle of the period *vice versa*.

Source of the Flow.—That the flow comes from the uterine cavity is absolutely proved by the following facts: it is found there, *post mortem*, in those who die during menstua-

tion ; it is seen to issue from the os externum uteri in cases of procidentia of the organ ; it has been seen oozing from the uterine mucous membrane in cases of inversion of the womb ; and when there is mechanical obstruction of the os uteri the menses do not appear, but accumulate and distend the uterine cavity.

Vicarious Menstruation — This is a flow of blood from some other organ recurring at the monthly periods and taking the place of menstruation. It may occur from the hemorrhoidal vessels, the lungs, the skin, the nails, the mammary glands, ulcerated surfaces, and many other parts.

Normal Suspension of Menstruation. — It is temporarily suspended during pregnancy and lactation, and ceases permanently after the so-called "change of life," at about forty-five or fifty years of age. Numerous exceptions must be noted to each of these statements.

CHAPTER VI.

MATURATION, FECUNDATION, AND NUTRITION OF THE OVUM.

WHEN a woman reaches the age of puberty, the ova that have remained dormant in her ovaries since infancy, begin one by one to grow. When full growth is attained, and the ovum is ready to be discharged from the ovary, it presents the structures shown in Fig. 26, page 72, viz.: the delicate cell-wall ("vitelline membrane") with its contained vitellus, germinative vesicle (nucleus), and germinative spot (nucleolus), is not only surrounded by the zona pellucida, but the zona pellucida itself is surrounded, on the outside, by *another* layer of cells, which from their shape and position constitute the zona radiata (corona radiata). Seen with a high magnifying power, radiating striæ may be observed passing through both zones—supposed to be minute canals through which the ovum takes up nutriment from without.

In the very limited peri-vitelline space between the vitelline membrane and zona pellucida, is a fluid in which the ovum really *floats*, as is demonstrated in fresh specimens by the part containing the nucleus always turning uppermost.

Inside the vitelline membrane is the yolk, composed of two different materials—*protoplasm* and *deutoplasm*.

The protoplasm forms a fine network throughout the little mass, while in its meshes are contained albuminous and fatty granules constituting the deutoplasm. These occupy a central position, leaving a peripheral zone of protoplasm from which they are absent.

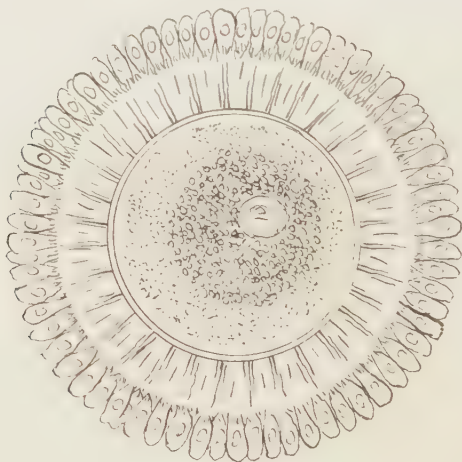
The nucleus is large and round, formed of a limiting membrane which contains fluid and a reticulum of chromatin. The nucleolus is conspicuous and exhibits amœboid movements which have been observed under favorable circumstances for

several hours after removal from the ovary. The ovum shown in the figure was obtained by ovariectomy from a woman of thirty years, and drawn while fresh in the liquor folliculi. It represents a *full-grown ovum before maturation*.

MATURATION.

This term—meaning *ripening*—should be abolished. The idea of an ovum getting ripe (like a fruit) has no proper foundation. Recently the term has been restricted to the process by which the full-grown ovum discharges its polar globules and becomes a female pronucleus ready to unite with the sperm element. Maturation is therefore the preparation of the ovum for fecundation.

FIG. 26.



Full-grown human ovum.

The process is as follows: The nucleus (germinal vesicle) of the ovum instead of remaining near the centre, moves toward and reaches the vitelline membrane. Then the nucleus divides, by the usual proceeding of mitosis, into two very unequal parts, the smaller part being finally protruded

through the vitelline membrane into the peri-vitelline space, where it remains outside, completely separated from the larger part of the nucleus, which moves back again toward the centre of the vitellus. The smaller extruded part is known as a *polar globule*. Then this process is repeated: the nucleus again approaches the vitelline membrane, and again undergoes the same unequal mitotic division with protrusion of the smaller part into the peri-vitelline space, and the consequent separation of a *second* polar globule. Once again the nucleus recedes to its central position and is now known as the *female pronucleus* or "true female sexual element" (Minot). It is ready for, and capable of impregnation: union with the *male* sexual element.

FECUNDATION.

Fecundation or impregnation is the union of the germ cell of the female with the sperm cell of the male. As the germ cell throws off its polar globules to become a female pronucleus before it is ready for this union, so the sperm cell throws off a part of its structure to become a male pronucleus for the same purpose, as will now be described.

The spermatic fluid (*sperm, semen, seminal fluid*) contains millions of histological elements, somewhat resembling ciliated epithelium cells, called spermatozoa (spermatozoids). By waving of its long cilium the spermatozoon moves about at a rate, it is estimated, of one inch in seven and a half minutes—a power it may retain for eight or ten days after being introduced into the female genital organs, and upon which the fecundating potency of the semen chiefly depends. While the spermatozoon has long been known to possess a (so-called) head, body, and tail (Fig. 27), recent and improved methods of observation have shown it to be a much more complex structure. Attached to the body and tail is an extremely delicate *spiral membrane*, which, when the tail moves, imparts to the whole organism an axial rotation; while from the anterior end of the head there projects a *spear*, twice as long as the head, and having one barb, something like a fine crochet-needle. (See Fig. 28.)

In Figure 28 (from Cunningham's *Anatomy*), representing diagrammatically the structure of a spermatozoon, other parts are seen which need not be described in detail.

No one has ever seen the meeting of a *human* ovum and spermatozoon, but we assume it to be the same as in other mammals in which the process *has* been observed. During coition the cavity of the uterus (and probably the Fallopian tubes also) receive the discharge of seminal fluid from the male. In other placental mammals the point of meeting between the ovum and spermatozoa, where impregnation takes place, is the Fallopian tube, somewhere near the junction

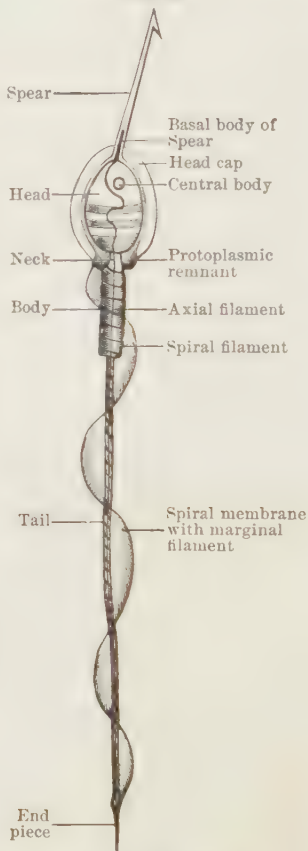
FIG. 27.



Human spermatozoa.
(After RETZIUS.)

A, Side view; B, Front view.

FIG. 28.



Structure of a spermatozoon
(diagrammatic).

of its outer and middle third—that is, one-third of the way from the fimbria to the uterus. “The exact spot is remark-

ably constant for each species" (Minot). It is presumably the same in man.

Usually only *one* spermatozoon enters the ovum in a normal impregnation. Numerous others surround the ovum, by which they seem to be attracted; some get into the perivitelline space, but only one penetrates the vitelline membrane, and enters the vitellus. At the point where this entrance is about to take place the vitelline membrane has been seen to protrude itself into a little elevation which is afterwards withdrawn, leaving a slight hollow or depression, into which the spermatozoon enters head first; and the head having entered, the locomotive tail is left outside in the perivitelline space. It is yet unsettled as to whether a *part* of the tail enters with the head, but, however this may be, everything except the head soon disappears, and the head itself, rich in chromatin, grows, develops a network appearance in its interior, and (in some animals) surrounds itself by a membrane, and is thus transformed into a nucleus-like body, the *male pronucleus*.

The two pronuclei (male and female) now exhibit active amœboid movements and both travel toward the centre of the ovum where they eventually meet, fuse together, and thus fecundation is complete. In the rabbit and mouse one pronucleus has been seen to assume a crescentic shape and embrace the other before fusion takes place.

The whole ovum, after union of the male and female pronuclei, is called the "*oosperm*" (*ωον*, an egg; *σπέρμα*, seed.)

Changes Taking Place in the Ovum after Fecundation.—

Our knowledge of the earlier stages of embryological development is based *entirely* upon observations on other animals. No one has ever seen an impregnated human ovum earlier than the third day after fecundation. In three days immense changes can occur. In the egg of the chick after only about *one* day of incubation (27 hours) the medullary groove has been partly converted into a canal; primitive segments to form the bodies of the vertebræ and traces of blood vessels can be distinctly seen. In the *Amphioxus* (a fish-like organism) spawning and the union of ova with the sperm cells always takes place in the evening (5 to 7 P.M.), but in eight hours (4 to 5 next morning) the vitelline membrane bursts, the embryo escapes

and becomes a free independent individual swimming about on the surface of the water by the waving of cilia on its ectodermal cells.

Lacking observations upon the human ovum itself, the best we can do is to assume that the earliest beginning of the embryo and its appendages must be more or less the same in man as in other animals nearly allied to him.

SEGMENTATION.

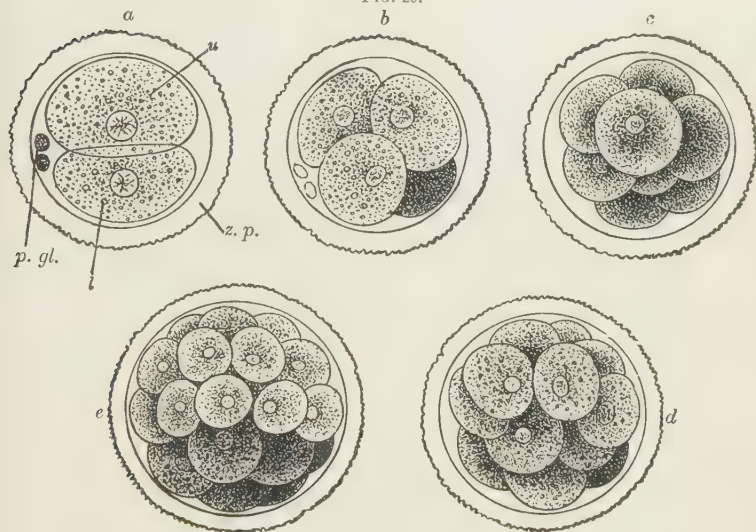
Development begins with cleavage of the yolk—segmentation of the vitellus—not of the vitelline *membrane* (which remains entire for the present as a sort of egg-shell), but of the vitellus within it. This division or segmentation is accomplished by the usual process of karyokinesis (mitosis) which need not here be described. The nucleus divides, then the cell. The two cells thus formed divide into four, the four into eight, the eight into sixteen, and so on, until a great number are produced. This mass of cells when viewed externally, somewhat resembles the outside of a mulberry in shape, hence it has been called the *morula* or mulberry mass. (See Fig. 29, “e,” page 77.)

The two cells resulting from the first segmentation differ in *size* and *appearance*, as well as in their inherited endowments and future destiny; and so do the two groups of cells resulting from their further subdivision, and these groups again differentiate into cells or groups of cells with still different peculiarities and destinies; and with progressive development this process of *differentiation* is constantly going on; and of *necessity*, for only in this way is it possible for these primitive cells of the ovum to become, as we know they do, the almost infinite variety of cells composing the tissues of the human body.

At the morula stage of development two distinct groups of cells are distinguishable, as shown in Fig. 29, page 77. These are: *first*, the *epiblast* or *ectoderm* cells which will form the *external* covering of the body, and *second* the *hypoblast* or *entoderm* cells to become the epithelial lining of the *interior*. The relative arrangement of these two groups of cells is shown in Fig. 29.

A little later the entoderm cells form a somewhat central mass, while the ectoderm cells close in and surround them, except at one point called the blastopore. (See Fig. 30.) The blastopore however will soon close, then the entoderm mass of cells becomes *entirely* surrounded and enclosed by ectoderm. Between the entoderm and ectoderm a little fluid begins to accumulate, indicated by the light space shown in B, Fig. 30.

FIG. 29.

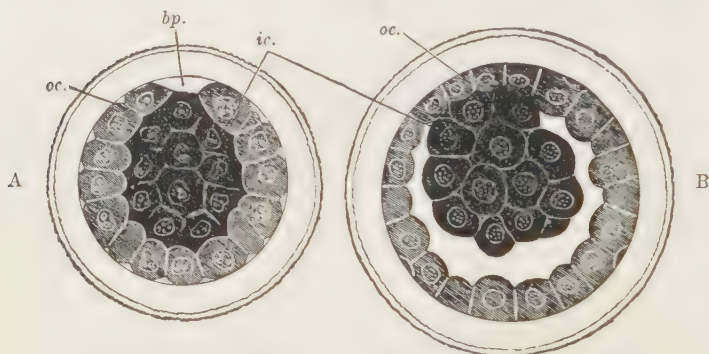


First five stages of segmentation (rabbit's ovum)—a, b, c, d, and e. In a, b, and c the epiblast cells are larger than the hypoblastic ones. In e the epiblast cells have become smaller and more numerous than the hypoblasts, and the epiblastic spheres are beginning to surround and close in the hypoblast cells. zp. Zona pellucida. p. gl. Polar globules. u. First epiblast cell. l. First hypoblast cell.

This fluid increases and begins to separate the hypoblast cells from the surrounding epiblast, except at the site of the former, but now obliterated, blastopore. By further accumulation of fluid the ovum becomes distended into a vesicle—to be known as the *blastodermic vesicle*, or *blastula*.

As shown in Fig. 31, the inner mass of entoderm (hypoblast) cells is compressed against the epiblast (ectoderm) layer, by the fluid of the blastodermic vesicle, so that it assumes a crescentic shape, lining only a part of the surrounding and enclosing epiblast. This part will indicate the *embryonic area*—where the body of the embryo will begin to form—while the remaining larger portion of the blastodermic vesicle must be known as the *non-embryonic* or *extra-embryonic* portion.

FIG. 30.



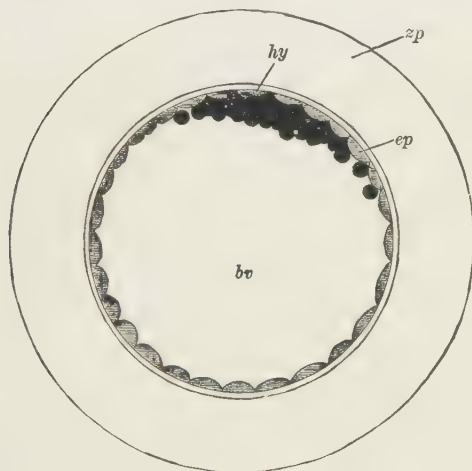
Two further stages following segmentation (rabbit's ovum). *oc.* Epiblast. *ic.* Hypoblast. *bp.* Opening in epiblast (blastopore) not yet closed. In B this opening *has* closed.

As development proceeds, the limited crescentic mass of entoderm cells will however extend itself in every direction until it *completely* lines the entire interior of the epiblast—embryonic and non-embryonic portions both. While these processes have never been observed in *human* embryos, there is no reason why another explanation, suggested by some observers, should not be accepted, viz.: that instead of the horns of the entoderm crescent extending round the interior of the ectoderm, fluid first begins to form in the centre of the entodermic mass of cells, and by accumulation distends the entoderm centrifugally until it comes in contact with the surrounding epiblast. Whichever mode of *production* is correct, what we want to realize is the simple *fact* that at this stage the blastodermic vesicle is a two-layered structure—a layer of epiblast-covering on the outside, and a layer of hypoblast-lining on

the inside, and these two layers are in contact with each other. As Minot expresses it: "The mammalian body may be defined as two tubes of epithelium, one inside the other"—hypoblast (entoderm) inside, epiblast (ectoderm) outside.

Rauber's Layer.—Thus far we have regarded the ectoderm and entoderm as being each composed of a *single layer* of cells. The ectoderm, however, by a rapid multiplication of its cells soon splits into two layers—a superficial layer of small cells, and an inner layer of larger ones. The superficial layer extends all round the blastodermic vesicle, and is

Fig. 31.



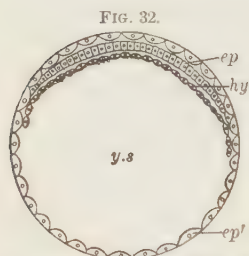
zp. Zona pellucida. ep. Epiblast. hy. Hypoblast. bv. Cavity of blastodermic vesicle.

known as the *covering layer of Rauber*, by whom it was first described, but the inner layer is limited to the embryonic area. Over this latter area the covering layer of Rauber will soon (sixth day) disappear, leaving the inner as the true ectoderm, as shown diagrammatically in Fig. 32.

The significance of Rauber's layer is unknown. We may here dismiss it from further consideration. Leaving it out, we again come back to regard the ovum as composed of *two* layers: ectoderm and entoderm, as before stated.

From these two layers, and between them, a *third* layer will soon develop, viz., the *mesoblast* or *mesoderm*. It is unnecessary here to dwell upon the first beginning and early development of the mesoderm about which there is some dispute. Suffice it to say that it begins to appear towards what will be the posterior or caudal region of the embryonic area and gradually spreads circumferentially in all directions until eventually it extends completely around the blastodermic vesicle which thus becomes *tri-laminar*: it has *three* layers, ectoderm on the outside; entoderm on the inside; mesoderm between the two.

Remember that these changes have all taken place inside the vitelline membrane, and while the ovum is yet in the Fallopian tube. The growing ovum is of course constantly increasing in size, which causes distention and thinning of the vitelline membrane. By the time the ovum has passed from the tube into the uterus and has reached the spot on the uterine mucous membrane where it will remain embedded to continue its further development, the vitelline membrane has become so extremely thin that it now melts away and disappears. It may be said the human egg has now "*hatched*" by the breaking up and disappearance of its vitelline membranous "*shell*." It is important to know for reasons hereafter stated, that



Mammalian blastodermic vesicle. *ep*, non-embryonic epiblast extending all around the ovum; *ep*, embryonic epiblast confined to embryonic area, over which *ep'* (the layer of Rauber will soon disappear; *hy*, hypoblast or entoderm; *y.s.*, yolk sac.

this liberation of the ovum from the cavity of its vitelline membrane only takes place when the ovum has reached its point of anchorage on the uterine mucosa and *not before*. If it *did* take place before, the ovum would then become anchored to the mucous membrane of the Fallopian tube and a tubal pregnancy result. The time after impregnation when the ovum passes from the tube to the uterus is unknown in man: it is *thought* to be several days: or something less than a week.

Starting out now with the three layers—ectoderm, mesoderm, entoderm—it is from these that all parts of the future embryo will be evolved.

Exactly what organs are developed from each layer is somewhat unsettled but enough is known to warrant the following statement :

The *ectoderm* (epiblast) forms the epidermis and its appendages: hair and nails; its glands, including the mammary glands; the nervous system: brain, spinal cord, ganglia, and nerves; the organs of special sense; the mouth and anus.

The *mesoderm* forms the skeleton: bones, cartilages, ligaments, connective tissues and bone marrow; the heart, blood-vessels, and blood; the muscles; the spleen and lymphatics; the serous membranes: pericardium, pleura, and peritoneum, and the genito-urinary organs.

The *entoderm* (hypoblast) forms the epithelial lining of the digestive tract and its glands, including liver and pancreas; also of the respiratory tract, larynx, trachea, and lungs; and of the pharynx, tonsils, Eustachian tube, and thymus and thyroid glands. It also forms the notochord; and the epithelial lining of the bladder and urethra.

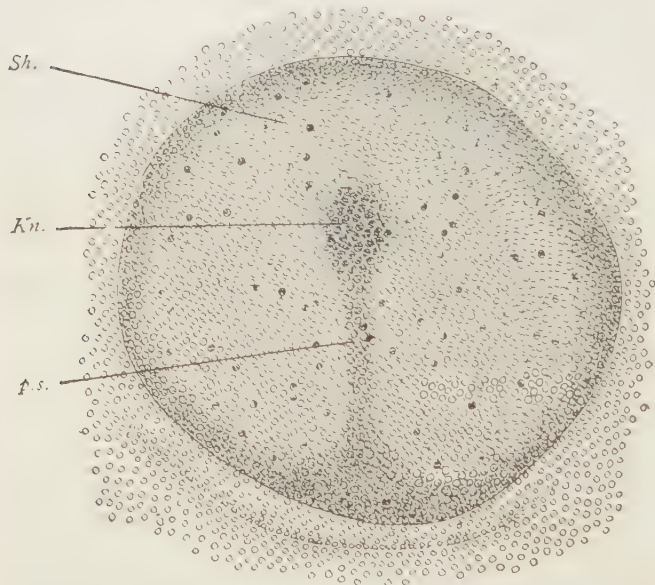
Finally, all three of these membranes, as we shall see, contribute to form the fetal appendages, amnion, chorion, placenta, etc.

It must be understood that no organ in the body is formed *exclusively* of any one of these three germ-layers. What we mean is that the several structures named have their *origin*—their embryonic *beginning*—in the special layer referred to. Later on, more than one layer becomes involved in the development of the completed organ. Thus the brain and mammary glands *originate* from the ectoderm but they must also have bloodvessels and blood and other tissues, derived from the mesoderm. So of other organs. The lung derives its epithelium from the entoderm, but its muscles, vessels, and pleural covering come from the mesoderm.

In now studying embryonic development from an obstetrician's point of view, it is with the structures concerned in the *nutrition of the growing ova* that we are chiefly interested. When a child is born, we observe (first) the infant itself, and (second) its appendages—the umbilical cord, placenta, membranes and liquor amnii. It is with these last that we are chiefly concerned, but to understand their origin and development some knowledge of the early stages in the development of the embryo itself will be required.

The Embryonic Area: Embryonic Shield.—Thus far we have regarded the growing ovum as a trilaminar vesicle—the blastodermic vesicle—a minute globular sac or cyst composed of the three layers: ectoderm, mesoderm, and entoderm, with nutritive pabulum (yolk) in the central cavity. Only one small part of this trilaminar vesicle will form the body of the embryo—we call it embryonic area: from its shield shape

FIG. 33.

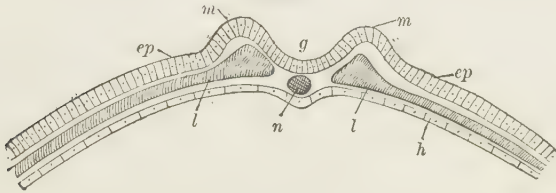


Surface view of the embryonic shield of the blastodermic vesicle of a dog 13 to 15 days old—precise age unknown. *Sh.* Embryonic shield. *Kn.* Hensen's knot. *p.s.* Primitive streak. 100 diameters. (From MINOT, after BONNET.)

it is also called the embryonic shield. The surrounding much larger part of the blastodermic vesicle,—*not* taking part in forming the embryonic body,—is the non-embryonic or extra-embryonic portion of the ovum. If we imagine for a moment that this terrestrial globe on which we live were nearly all ocean, with no land formation except Australia, then Australia would represent the embryonic area, and the remaining ocean the extra-embryonic regions.

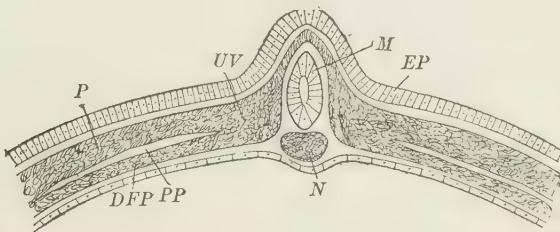
Near the centre of the embryonic area first appears a condensed knot of cells (the knot of Hensen) which indicates the place where the ectoderm and entoderm have united together. It corresponds with the spot where the inner mass of entoderm cells first formed inside the ectoderm. The mesoderm has not

FIG. 34.



Cross-section of embryo in the dorsal region, showing beginning of medullary folds and groove. *m, m.* Medullary folds. *g.* Medullary groove. *ep.* Epiblast. *n.* Notochord. *h.* Hypoblast. *l, l.* Peripheral plates of mesoblast.

FIG. 35.

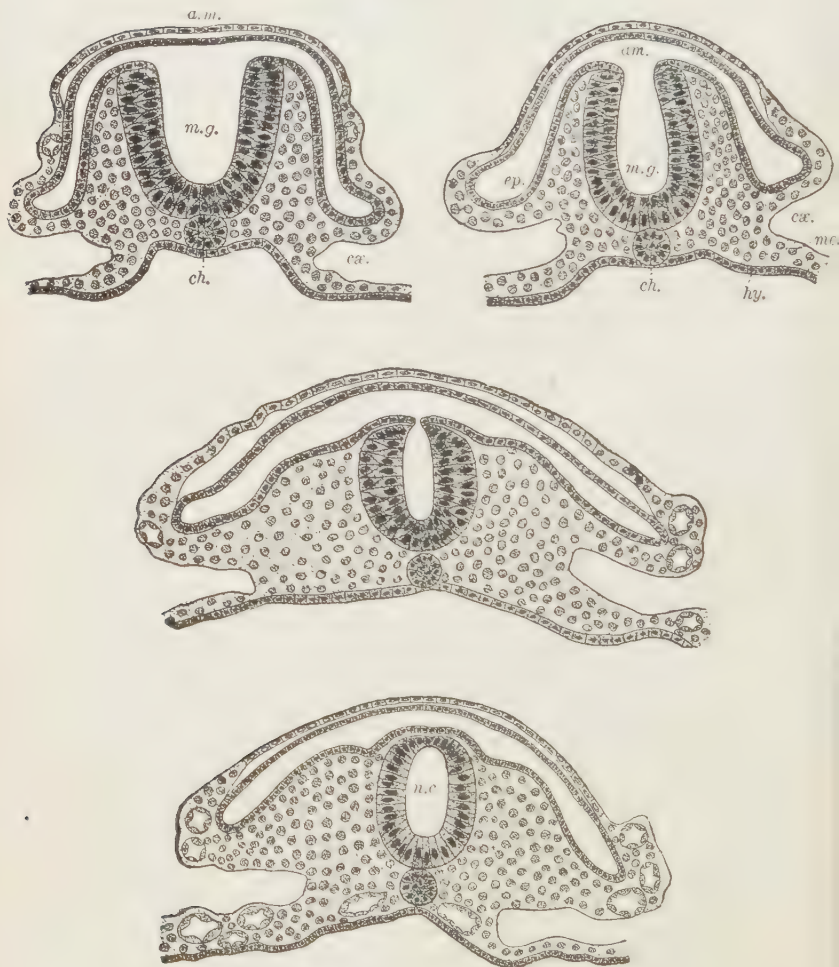


Cross-section of embryo in dorsal region, showing extension of mesoblast between epidermal epiblast and involuted portion of epiblast lining neural canal. *Ep.* Epidermal epiblast. *M.* Epiblast lining neural canal. *UV.* Undivided part of mesoblast. *P.* Mesoblastic layer forming body wall (somatopleure). *DFP.* Mesoblastic layer forming intestinal walls (splanchnopleure). *N.* Notochord. *PP.* Commencing pleuro-peritoneal cavity.

yet obtruded itself between the entoderm and ectoderm at this point of union; but it will do so later on. Extending from Hensen's knot toward the periphery of the embryonic shield appears first a streak which deepens into a shallow groove in the ectoderm, known as the *primitive streak* and *primitive groove*.

Shortly after the formation of the primitive streak there appears round the anterior end of it, and extending a considerable distance beyond the end, a thickening of the

FIG. 36.



Stages in the conversion of the medullary groove into the neural canal. From tail end of embryo of the cat. *m.g.* Medullary groove. *n.c.* Neural canal. *ch.* Notochord. *ep.* Epiblast. *hy.* Hypoblast. *me.* Mesoblast. *cæ.* Coelom. *am.* Amnion. (After QUAIN.)

ectoderm known as the *medullary plate*. In the central axis of this plate a longitudinal furrow (the *dorsal furrow*) appears, which deepens into a groove (the *medullary groove*), and this groove is still further deepened by folds of the medullary plate rising up on the two sides and two ends of the groove, until the folds finally meet and join, converting the medullary groove into a canal—the *medullary canal*.

From this medullary canal the entire central nervous system is produced; the anterior end enlarges to form the brain, the remainder elongates to form the spinal cord. The caudal end of the medullary canal is the last to close. Some cells migrate through the wall of the canal to the outside and become converted into ganglia.

Thus we have seen how the nervous system is derived from the epiblast (from the external germinal layer) the medullary or neural canal, when first closed in, is *lined* by epiblast cells; these in time differentiate into nerve cells. The several stages in the formation of the medullary groove, medullary folds, and medullary canal are shown diagrammatically in Figs. 34, 35, and 36, pp. 83 and 84.

What becomes of the *primitive streak* (*primitive groove*)? It disappears. This groove is distinct from the medullary groove. While the *posterior* end of the medullary plate, by a sort of bifurcation, is seen to extend on each side of the *anterior* end of the primitive streak, at a point corresponding to the knot of Hensen, and while the two grooves are more or less in line, the one is distinct from the other. The medullary groove grows into the medullary canal, the primitive streak disappears. The one does *not* develop into the other, as was formerly supposed.

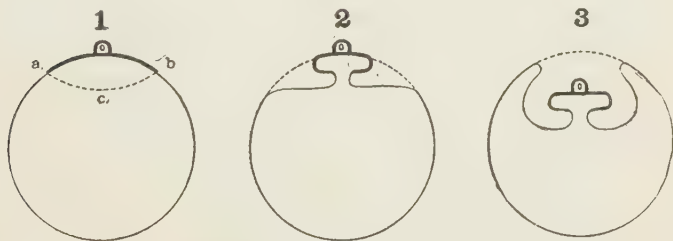
Lateral Folds (Abdominal Plates); Formation of Abdominal Cavity and Umbilical Vesicle.—In order to understand these it is absolutely necessary at this point to introduce a further, somewhat complicating statement, the full recognition of which however will greatly assist our comprehending the matter under consideration. This statement is that the *mesoderm splits into two concentric layers*, one inside the other. Thus our blastodermic vesicle really becomes *four-layered*: ectoderm on the outside, entoderm on the inside, and between them the *two layers* of mesoderm. This fact must be emphasized and remembered; otherwise we can understand nothing.

In order to form the body of the embryo and to provide a cavity for the internal organs, the embryonic area cannot remain spread out as a flat shield in line with the globular surface of the blastodermic vesicle of which it is a part. Nor does it. On the contrary the *margins* of the embryonic area—its *peripheral borders*—scoop inward and fold toward each other in an *anterior* direction, and will eventually meet and join in front, at a point that will finally become the *median line of the abdomen*. These folds of the blastodermic vesicle are therefore called *abdominal plates*, or *lateral folds*, one on *each side* of the abdominal cavity. The small embryonic area becomes, therefore, partially pinched off from the larger, extra-embryonic portion of the blastodermic vesicle. This pinched-off part is to *be*, and already *is*, in a rudimentary form, the body of the embryo, while the remaining *extra-embryonic* area will develop into the fetal appendages: the membranes, placenta, and cord. In Fig. 37, No. 1, the thick black line from “a” to “b,” indicates the small embryonic area of the blastodermic vesicle before the pinching off process has begun; the dotted line shows the margin of this area on the distal half of the bisected vesicle. On the top is seen the medullary canal formed of ectodermal medullary folds, as already explained. Fig. 37, No. 2, shows the margins of the embryonic area approaching each other, a contiguous part of the surrounding *non-embryonic* area being of necessity also drawn in. The folded off portion—the embryonic area—does not, however, stick out like a projecting knob on a level with the original contour of the blastodermic vesicle, as represented in No. 2. A further complication arises; the *real* condition being shown in Fig. 37, No. 3, where it is seen the folded embryonic area recedes or sinks in toward the centre of the blastodermic vesicle, while folds of the adjoining non-embryonic area begin to rise up *all round* it. These last-named folds will form the amnion and chorion, as explained further on.

The embryonic body now consists of two longitudinal canals or cavities, one above the other; the upper and smaller one being the medullary canal, in which will develop the brain and spinal cord; the lower and larger one being the abdomino-thoracic cavity, in which will develop the thoracic organs and abdominal viscera. The medullary canal was formed from

the *ectoderm*; in the formation of the abdominal cavity and its organs *all four* germinal layers—*ectoderm*, *entoderm*, and the *two layers of mesoderm*—are immediately concerned. While these four layers were *all* folded in at the point of pinched constriction, the rising folds of the *non-embryonic* area that surround the embryonic body consist only of *ectoderm* and the outer one of the two layers of *mesoderm*. This implies a separation of the two *mesoderm* layers from each other, and the formation of a cavity between them; and this, of course, occurs. The *inner* layer of the *mesoderm* must now be known as the *splanchnopleure*—the *splanchnic* layer—(from *σπλάνχνα*, viscera), because it forms the serous coverings (pericardium, pleura, and peritoneum) of the internal organs as well as their muscular walls and bloodvessels; while the *outer* layer of the *mesoderm* will be known as the *somatopleure*—the *somatic* layer—(from *σῶμα*, the body), because it forms the body wall; the muscular and bony walls of the chest and abdomen, together with the pleura and peritoneum, lining those walls inside; and the bloodvessels.

FIG. 37.



Folding off of embryonic body.

The large space between these *splanchnic* and *somatic* layers of the *mesoderm* is called the *cælum* (from *κοίλωμα*, a cavity); that part of it enclosed within the embryonic body becomes, of course, the *pleuro-peritoneal* cavity, which at first is all one, the *diaphragm* having not yet developed.

The Umbilical Vesicle.—When the four germinal layers of the embryonic area became folded in to form the abdominal cavity, it is evident that only a *small part* of the entire *entoderm* was enclosed within the cavity, the much larger portion

remaining as the innermost entodermal lining of the *non-embryonic* part of the blastodermic vesicle. This excluded part (*not* within the abdomen) is the *umbilical vesicle*. Note that it is lined by *entoderm*—the epithelial layer—which is continuous with the same layer lining the primitive alimentary canal; and that over this is the splanchnic layer of mesoderm, continuous with the same layer forming the serous and muscular coats of the alimentary organs. This umbilical vesicle (called also “*yolk-sac*” contains some of the original vitellus or yolk, but the contents of the vesicle (whether old yolk or new) rapidly increase, so that the vesicle itself is enlarged and distended, reaching its largest size during the fourth week. By what means this mass of nutritive pabulum is thus increased we do not know; but we do know that it forms, while it lasts, the principal storehouse from which the growing embryo derives its nourishment. The constriction between the abdominal part of the entoderm and that part lining the umbilical vesicle is not yet complete; a passage is left between the two (the “*vitelline duct*”), through which foodstuff can pass from the umbilical vesicle into the alimentary canal. Furthermore, in the splanchnic layer of mesoderm covering the umbilical vesicle, bloodvessels soon appear, and thus contribute to absorb nutriment from the yolk sac and convey it to the body of the embryo. Gradually the umbilical vesicle grows smaller; its contents are being absorbed, until finally (at about the twelfth week), the vitelline duct has become a scarcely visible thread (the yolk-stalk), at the end of which there remains a mere pin-head cavity—the last remnant of the umbilical vesicle itself.

The Area Vasculosa.—The bloodvessels in the wall of the umbilical vesicle (above mentioned) are the first bloodvessels to appear, and since in the chick, in which their development has been observed, they only occupy a *part* of the umbilical vesicle immediately surrounding the embryo, this part has been termed the *area vasculosa*. In the human embryo the “*entire yolk sac becomes vascularized throughout*” (Minot). While never seen in man, the vessels are presumed to develop as they have been observed to do in other animals, thus a network forms in the splanchnic mesoderm which soon exhibits yellowish spots, called blood-islands, because the cells in them will become blood corpuscles. The network is at first solid,

but later on the strands forming it become hollow tubes (primitive bloodvessels), and the clusters of cells in the interior break apart and become free in the cavity of the vessel, thus producing the first blood corpuscles, which multiply by mitotic division. The vessels are all about the same size, except that the vascular area terminates peripherally, in one larger vessel—the so-called *sinus terminalis*. As yet there is no circulation in these vessels. They form during the first and second days. The heart has not yet formed, but it is beginning to develop as a *closed* hollow tube. The vessels are as yet *extra-embryonic* as is, of course, the umbilical vesicle in which they form, but they proceed to extend into the embryo toward the heart and finally reach it, then the surfaces of contact between the heart and the vessels melt away, the cavities of the heart and vessels join, and the heart, already pulsating *before* uniting with the vessels, still beats on, and the blood circulation begins. Thus, the first circulatory organs do *not* begin from the heart as a centre and branch out, as one is apt to suppose, but the minute vessels begin in the area vasculosa and project their larger stems inward to join the heart.

When the umbilical vesicle, with its contained nutritive pabulum, disappears, or dwindles almost to nothing, the bloodvessels disappear also. This source of nutritive supply for the embryo having thus become exhausted, a new device for the same purpose is provided by the formation of the amnion and chorion, the development of which has been simultaneously going on.

The Chorion and Amnion.—We have seen that, when the pinched or “folded off” embryonic area sank in toward the centre of the blastodermic vesicle (see Fig. 37, p. 87), the surrounding non-embryonic portion of the vesicle began to rise up, in a double fold, *all around* the embryonic body. The two germinal layers that form these rising folds are the *ectoderm* and the *somatic* layer of the *mesoderm*. The folds are known as amniotic folds, the folds of the amnion. By reference to Figs. 3 and 4, Plate 1, it will be seen these rising folds arch over the back of the embryonic body, and finally meet above it. When they meet and *touch* each other, the surfaces of contact melt away, but the *inner* fold of one side unites with the inner fold of the other, and the *outer* fold of one side unites with the outer fold of the other. The inner

90 MATURATION, FECUNDATION, AND NUTRITION.

DESCRIPTION OF PLATE 1.

The germinal layers are shown with wide intervening spaces simply for clearness of demonstration. Entoderm, green; mesoderm, red; ectoderm, black.

FIG. 1 simply shows the three—really four—germinal layers with the separation of the mesoderm into somatopleure and splanchnopleure. It is an entirely artificial diagram.

FIG. 2.—Here the ectoderm has folded in to form *m.c.*, the medullary canal, and a part of the entoderm has been pinched off to form the notochord (*noto.*), with which we shall have nothing to do. The mesoderm has not yet united to cover in the entire vesicle (see page 83), but it will soon do so, then the four layers will become complete as in Fig. 1.

FIG. 3.—The folding off has begun, also sinking of the embryo toward the centre of the blastodermic vesicle, and rising up of the amniotic folds. *Ect. 1*, ectoderm covering body of embryo; *ect. 2*, ectoderm forming amniotic fold accompanied with somatic layer of mesoderm, *som.*; *co.*, coelum or cavity to become pleuro-peritoneal cavity. *Umb. ves.*, umbilical vesicle; its upper narrow part to become alimentary canal. This vesicle is accompanied by splanchnic layer of mesoderm (*spl.*).

FIG. 4.—The amniotic folds have arched over and united to form *a. a.*, the amniotic cavity. The folding in of the abdominal walls (lateral plates) has progressed and will soon become complete, converting a part of *co.* into *p. p.*, the pleuro-peritoneal cavity. Note that the *external* layer of the *double fold* of amnion (in Fig. 3) has united with its fellow in Fig. 4 and become continuous with the original external covering of the blastodermic vesicle, to be now called the chorion.

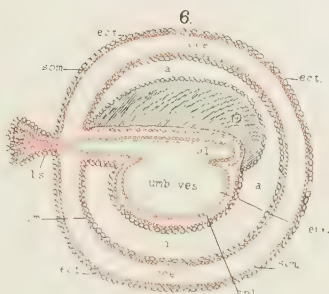
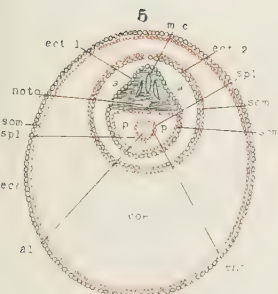
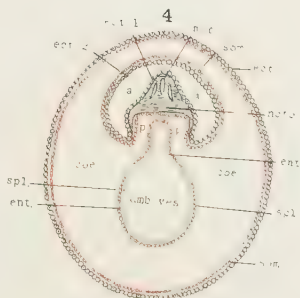
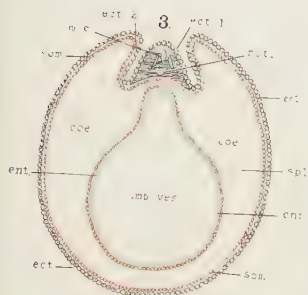
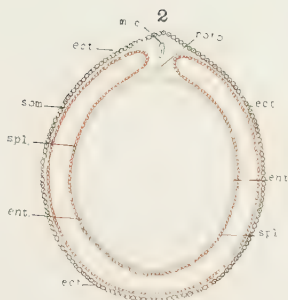
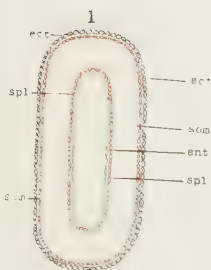
FIG. 5.—The abdominal walls have united, closing in the primitive alimentary canal and pleuro-peritoneal cavity. The umbilical vesicle is supposed to have disappeared. *ect.* Ectoderm of both embryonic and non-embryonic portion of blastodermic vesicle—now the chorion. *ect. 1*. Ectoderm forming skin of embryo. *Ect. 2*. Ectoderm lining cavity of amnion. *Spl.* Splanchnic mesoderm to form vessels, with muscular and peritoneal coats of intestine, etc. Three different layers of somatopleure (*som.*) are seen: one lining the abdominal cavity to form its muscular walls; one in the amniotic wall; and one in the chorion. Observe that the amniotic cavity with its contained embryo *appears*, in this transverse section, to be entirely cut off from the chorion.

FIG. 6.—Longitudinal section showing *b.s.*, body stalk, and short projection into it of entodermic pouch of allantois continuous with alimentary canal. The cavity of the amnion (*a. a.*) is expanding, so that *co.*, the coelum, will soon be obliterated by the amnion coming in contact and uniting with the chorion, as seen in Fig. 8.

FIG. 7.—The fetus has changed its *position*: instead of being horizontal and supported only by its caudal body stalk, its head has descended and body-stalk has grown to a more central position on the abdomen, where the umbilical cord will appear as in Fig. 8.

FIG. 8.—Here the embryo has receded from the amnion by elongation of the cord. The ectoderm of the amnion does *not* cover the cord, but stops at its placental end. While to show this the cord is *incorrectly* represented without *any* sheath, it is in reality sheathed by a special layer of epithelium continuous with the skin of the child, which is not shown. The coelum is *almost* obliterated by the near approach of the somatic mesoderm of the amnion with the somatic mesoderm of the chorion. The chorial villi are represented each with a core of mesoderm to form its bloodvessels. The shorter villi will disappear; the longer ones (on the left) will form the placenta. *a.* is the amniotic cavity filled with liquor amnii: *al.* the alimentary canal. *Spl.* Splanchnic layer of mesoderm covering viscera. *Spl. 1*. Somatic mesoderm lining abdominal cavity.

FIGS. 9 and 10 show how cavity of coelum becomes the pleuro-peritoneal cavity. FIG. 9 is an elongated reproduction of Fig. 1, showing original four germinal layers with protruding buds at *a* and *b*. In FIG. 10, "*a*" has become the lungs and pleural cavities; "*b*" has become the alimentary canal and peritoneal cavity. *dia.* diaphragm. The red crosses are the pleural and peritoneal cavities. *al.* alimentary canal. The epithelial lining (entoderm) of the lungs and digestive organs are continuous, just as in the adult we find the lining of the pharynx, larynx, trachea, etc., to be so. In these figures little regard is paid to anatomical correctness. The object is to show the *relations of the germ layers*, nothing else.



fold will now be called *the amnion*, for it has enclosed the amniotic cavity which is to fill up with liquor amnii; the outer fold will be known as *the chorion*.

Observe that the inner and outer folds have become *completely separated* from each other, and that the embryo with its amnion (as shown in Figs. 4 and 5, Plate 1) appears to be entirely *cut off* from the rest of the blastodermic vesicle and chorion. I say the embryo *appears* to be thus completely cut off. Is it really so? It cannot be. If it were, the embryo would die like an amputated limb. What then is the actual condition? Observe that in the figures we are looking on the cut surface of *transverse* sections of the embryonic body. We might make hundreds of such sections, beginning at the head and proceeding toward the tail-end, and they would all show the same "cut off" condition. But if we proceeded further, and made sections through the tail-end itself, we should there find the rising folds of amnion did *not* meet each other and melt away. On the contrary, there would be seen between the two rising folds a solid stalk of mesoderm by which the inner fold (the amnion) remains united to the outer fold (the chorion). The body of the embryo, therefore, is *not* entirely cut off; it hangs by this (so-called) "body stalk," or *bauchstiel*, projected from near its caudal end, and thus maintains its connection with the outer fold (chorion), through which nutriment is to be taken in from the exterior. This will be readily understood by reference to Figs. 6 and 7, Plate 1, representing *longitudinal* sections of the embryo.

It should be noted that the outer layer of the rising amniotic folds (which we now call chorion) is *perfectly continuous* with the remainder of the non-embryonic portion of the blastodermic vesicle, from which the "rising folds" themselves originally sprang. There is no division between the part that *did* rise up over the sunken embryo and the part that did *not*. Thus the mouth of the little well into which the embryonic body sank, so to speak (see Figs. 3 and 4, Plate 1), has been arched over by the united folds of chorion, and the globular contour of the blastodermic vesicle becomes once more restored and complete. Now, let us emphasize that this *entire* contour—continuous and complete—is *all* to be known as "*the chorion*."

The chorion is composed of ectoderm lined on the inside by a somatic layer of mesoderm. (See Figs. 4, 5, and 6, Plate 1,

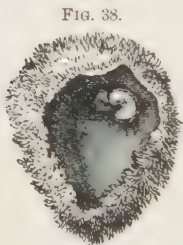
som. and *ect.*) The splanchnic and somatic mesoderm layers have become widely separated in the non-embryonic part of the blastodermic vesicle. The somatic layer lines the chorion inside; the splanchnic layer covers the umbilical vesicle on its outside. (See Figs. 3 and 4, Plate 1, *spl.*) The large space between them is the *cœlum* or body cavity (so called). It is occupied by a fluid. That part of this cœlum enclosed by the lateral plates (abdominal plates) within the embryo is the pericardio-pleuro-peritoneal cavity, to be afterward divided as the name implies.

When the ovum enters the uterus and the vitelline membrane melts away, the chorion becomes the external covering of the blastodermic vesicle, with which it comes in contact with the uterine wall and absorbs nutriment. To further this absorption, villi appear, projecting outward from the external surface of the chorion, and each villus receives a capillary loop of bloodvessels supplied by the mesoderm. (See Fig. 8, Plate 1.)

The amniotic cavity, more and more distended with liquor amnii, will eventually come in contact with the chorion and unite with it, thus completely obliterating the cavity of the cœlum, which previously existed between the amnion and chorion. (Fig. 8, Plate 1.)

This double membrane—the united amnion and chorion—is the membrane which forms the “bag of waters” that bursts in child-birth.

Human ovum, with contained embryo, about the end of third week. (From KOLLIKER, after ALLEN THOMPSON.)



Some time during the third month, the villi over a greater part of the chorion atrophy and disappear, hence this part is called the “*chorion laeve*”; while the villi of the remaining smaller part (*chorion frondosum*) grow larger and contribute to form the placenta. (Fig. 8, Plate 1.)

The early villi begin to appear about the end of the second week, and soon cover the entire chorion, giving the ovum its so-called “shaggy coat,” as seen in Fig. 38. At two months the villi of the chorion laeve begin to degenerate, and in a month or two more they have gone.

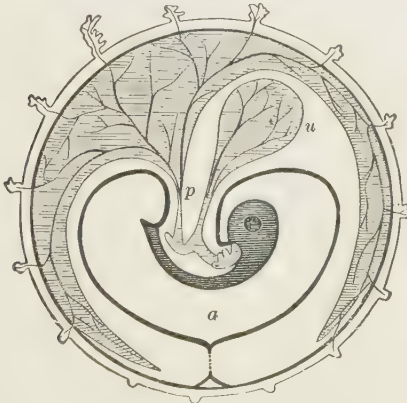
The Allantois.—In the human embryo there is no real allantois, such as is seen in the chick, the calf, and other mammals ; but there is a rudimentary modified form of allantois

FIG. 39.



Development still more advanced. *a, a.* Folds of amnion about to touch and join each other. *p.* Commencement of allantois.

FIG. 40.



Showing junction of amniotic folds at *a*. *u.* Umbilical vesicle *p.* Pedicle of allantois. The projecting folds of the allantois, passing round the embryo, and following the folds of the amnion, will soon join and unite, completely surrounding the ovum.

— allantoic stalk —constituting a part of the “body stalk,” previously mentioned (page 91), by which the embryo retains its connection with the chorion. One of the functions of the

allantoic stalk is to strengthen and perpetuate this connection by conveying bloodvessels from the embryo to the chorion, thus contributing to form the umbilical cord and placenta. We can best understand it by first describing the allantois as it is seen in the chick. Here we find a sort of protrusion or diverticulum of the entoderm projecting itself out of the embryo, just behind the stem of the umbilical vesicle or yolk sac. The entodermal lining of this diverticulum is continuous with the entodermic lining of the primitive alimentary canal: its cavity is continuous with the "hind-gut" of that canal.

FIG. 41.



Showing folds of allantois completely united, and their two layers in contact with epiblast and vitelline membrane, to form chorion with its villi. 1. Vitelline membrane. 2. Epiblast. 3. Allantois. 4. Umbilical vesicle. 5. Amnion (its internal layer, containing liquor amnii). 6. Body of fetus. 7. Pedicle of allantois, to become the umbilical cord.

It is covered on its outside by a splanchnic layer of mesoderm (in which develop its bloodvessels), a continuation of the same splanchnic layer of mesoderm which forms the vessels and muscular coat of the intestine. The allantois begins as a hollow pouch, as shown in Fig. 39, and soon grows and spreads circumferentially, as a globular flattened pouch, all round the embryo (Fig. 40), until its borders meet and join, as shown in Fig. 41. As shown in this last figure, the *cavity* of the pouch is getting smaller, and will soon disappear altogether

by the inner surfaces of the cavity coming in contact with each other and uniting to form a membrane. This membrane will distend until it comes in contact and unites with the chorion.

Returning now to the human embryo, we find the allantoic pouch of entoderm only extends a *very short distance* into the body stalk of mesoderm (see Figs. 6 and 7, Plate 1); the stalk, therefore, is composed of mesoderm *alone*, without any entodermal cavity continuous with the intestine, as seen in the chick. Note also that the body stalk itself is *very short*, so that the anterior (abdominal) surface of the embryo is close to the inner surface of the amnion. It will not remain so. The stalk will grow in length, as if it were projected out of the umbilicus of the embryo, until it become a foot (and sometimes several feet) in length. (See Fig. 8, Plate 1.)

Observe that the ectodermal layer forming the skin of the embryo stops at the fetal end of the cord, and also that the ectodermal layer lining the amnion stops at the placental end of the cord. The cord itself, therefore, is *not* covered with amnion, as was formerly supposed. In Fig. 8, Plate 1, the cord is represented as consisting of mesoderm alone; a naked stem of mesoderm without any sheath or covering. And so it would be if it had to get one from the amnion, for in receding from the child's abdomen, the amnion leaves no sheath behind it for the cord whatever. The cord, however, gets its sheath from a tube of ectoderm and somatic mesoderm which *follows* the lengthening body stalk. As the stalk grows, or seems to be projected out of the child's abdomen, the sheath of body-wall and ectoderm grows with it and *makes* its sheath. The external coat of the cord then is ectoderm continuous with the child's skin: on the skin itself the ectoderm cells differentiate into *epidermis*; on the cord, the ectoderm cells differentiate into the smooth membrane with which the cord is covered, no matter whether we call it modified epidermis or any other name. Inside this ectodermal covering is a poorly-developed (a differentiated or modified) layer of somatic mesoderm continuous with the somatic layer forming the muscular wall of the child's abdomen. *In* the sheath is the central core of splanchnic mesoderm and its bloodvessels carried there by the allantois. If the sheath were empty, its cavity would be found continuous with the cavity of the embryonic cœlum which is to become the pleuro-peritoneal

cavity, and thus in the cavity, we find the remains of the umbilical vesicle and of the rudimentary allantoic pouch, both of which, as we have seen, were continuous with the entoderm of the alimentary canal, and were covered with a splanchnic layer of the mesoderm, and both protruded into the celum. Thus, also, is explained the occurrence of umbilical hernia, when a piece of intestine protrudes into the cavity of the cord at its root, its cavity being really a continuation of the peritoneal cavity.

The formation of the tubular sheath of the cord may perhaps be made more intelligible by comparing the body of the embryo to a wound-up tape-measure. Let the tape represent the cord and the little metal ring that serves as a handle with which to pull it out, represent the amnion. Now pull out a foot of the tape: it is quite naked, so far as getting any sheath from the receding amnion is concerned. The sheath, therefore (if there were any), would come out of the measure itself, and be continuous with the box in which the tape was coiled. So the sheath of the cord comes out of the embryo, and is continuous with the somatic mesoderm and ectoderm, forming the wall of the abdominal cavity.

In Figs. 9 and 10 of Plate 1 I have endeavored to show how the celum—the space between the splanchnic and somatic layers of mesoderm—becomes the pleural and peritoneal cavities. In Fig. 9 we find the four germinal layers, just as in Fig. 1, except that at the points “*a*” and “*b*” in Fig. 9, budding dilatations are beginning to project. With continuous development the bud “*a*” becomes the lungs and the bud “*b*” the alimentary canal. The space marked by red crosses, above *dia*, the diaphragm, is the pleural cavity; below the diaphragm it is the peritoneal cavity.

The Placenta.—To understand the development of the placenta we must examine the progressive changes that take place in the mucous membrane (mucosa) of the uterus after impregnation. We have seen that even *before* impregnation when an ovule is expected to enter the uterus, the uterine mucosa becomes much thickened, convoluted, and more vascular. This normally hypertrophied mucosa in the absence of impregnation degenerates and is thrown off with the menstrual discharge, hence it is called “*decidua menstrualis*.”¹

¹ *Decidua* is derived from “*deciduus*,” a falling off; (*de*, from; *cadere*, to fall).

When impregnation *has* occurred, the exuberant growth and vascularity of the uterine mucosa continues, in the manner to be now described.

The entire mucous coat of the whole uterine cavity, from the os internum to the orifices of the Fallopian tubes, when thus thickened, is called the *decidua vera* (or *uterine decidua*). When the ovum enters the uterus, and reaches the spot where it is to remain, the decidua vera sends over it reflected folds that cover and enclose it, these reflected folds of the vera are known as the *decidua reflexa* (or *ovular decidua*, or *decidua capsularis*). That part of the vera which lies between the ovum and the muscular wall of the uterus, and in which the placenta will develop, is known as the *decidua serotina* (or *placental decidua*, or *decidua basalis*). (See Figs. 42, 43, and 44.)

FIG. 42.



Formation of decidua vera, which is represented by black coloring.

FIG. 43.



Formation of folds of decidua reflexa growing up around ovum.

When the fecundated ovum enters the uterus it is still surrounded by the vitelline membrane, but, having reached the situation where it is to remain in the uterine mucosa, the vitelline membrane melts away and the ovum is free. (See page 99.) By this time the ovum has of course become a blastodermic vesicle, and is covered by its external germinal layer, the *ectoderm*. The vitelline membrane having disappeared, the ectoderm would, therefore, seem to come directly in contact with the decidua vera. So it does in a way, but the contact is not thus simple, for the outer surface of the

ectoderm has become covered with an additional layer of cells, known as the *trophoblast* (or trophoderm), which must now receive our attention.

The Trophoblast.—In the diagrams we have represented the germinal layers as being composed of only *one row* of cells or layers one row thick. Of course they do not remain so. The body-stalk, we have seen, is composed of a *mass* of mesoderm cells, and the body of the embryo is made up of many layers.

FIG. 44.



Joining of folds of decidua reflexa around ovum, and thickening of decidua serotina where the placenta will develop.

So we find the ectoderm does not remain a single layer, but develops upon its external surface an additional, quite thick coat of cells, known as the *trophoblast*. And this is divisible into two distinct layers: *first*, an inner layer, made up of well-defined cuboidal or round cells, known as Langhan's layer (Langhan first described it), and, *second*, an outer layer, in which no cell-walls can be seen, or if there were any originally they have melted away, leaving a granular mass of protoplasm dotted all over with scattered *nuclei*: this is the *syncytium*, or syncytial layer. The *trophoblast* (composed of the Langhan and syncytial layers) already exists before the vitelline membrane disappears; it is, therefore, a fetal structure. When the ovum reaches the spot on the decidua vera where it is to remain, the vitelline membrane disappears, and the liberated ovum, clothed with trophoblast, comes in contact with the vera. And now occurs a

most remarkable and interesting event. The cells of the syncytium are phagocytic; in contact with the uterine mucosa they begin to destroy and consume the decidua vera, and thus, as it were, eat a hole in which the ovum really buries itself. Thus occurs fixation and "*implantation*" of the ovum in the substance of the vera. Over the point of entrance, folds of the vera rise and join, forming the *decidua reflexa*. Between the trophoblastic covering of the ovum and the muscular wall of the uterus, that is to say, at the bottom of the little cavity, there still remains unconsumed vera, constituting the decidua serotina.

We have now to consider the relations of the chorionic villi (covered with trophoblastic ectoderm, of course) with the decidua, and the changes in both which lead to the development of the placenta. It must first be noted that the decidua itself, during pregnancy, does not remain a one-layered structure. Three layers can be recognized.

First.—A superficial, thin layer (facing the uterine cavity), known as the *stratum compactum* because it is more compact in structure, from having a greater amount of interglandular connective tissue and a very *moderate* dilatation of the glandular follicles.

Second.—A much thicker layer immediately below the first, in which the tubular glands become *enormously* dilated, and even joined together, so as to form an irregular network of intercommunicating spaces with but little intervening connective tissue. It thus acquires a *spongy* character, and is known as the *stratum spongiosum*.

Third.—Still beneath this spongy layer, next to the muscular wall, is a thin layer known as the *basal* or unchanged layer, because it remains about as it was before pregnancy. It is composed chiefly of connective tissue.

During the early weeks of pregnancy the *entire* chorion, that is, the entire external surface of the blastodermic vesicle, is provided with projecting villi, which begin as mere ectodermal buds without any bloodvessels, but very soon each villus (as we have seen) receives a vascular core of mesoderm which carries a capillary bloodvessel. At first these vascular villi project into the reflexa, as well as into the decidua serotina. During the second month the vessels in the villi of the reflexa *begin* to disappear, and *after* two months the circulation

in the chorion is restricted to the serotina where the placenta is to develop. Coincidentally, the *villi* of the reflexa atrophy and disappear; and the reflexa itself, thinned by distention of its growing contents, and by the phagocytic action of ectodermal trophoblast, comes in contact, about the end of the third month, with the vera lining the rest of the uterine cavity, when it becomes subjected to *pressure* on both of its surfaces, which reduces it to such extreme thinness that in places it quite fades away, leaving the chorion in contact with the vera. This process goes on until during the fifth month the entire reflexa completely disappears.

We may now, therefore, dismiss the reflexa and return to the serotina where the placenta is to form.

The *plan of construction* in a complete placenta is simply this: Cavities form in the decidua serotina, into which maternal blood flows in and out. Projecting into these cavities come the chorial villi with their branching vascular tufts to be constantly bathed in the ebb and flow of maternal blood, just as an aquatic plant projects its stem and branches from the bottom of a pond, to be constantly bathed in the surrounding water. The maternal and fetal bloods do not mix: the blood coming into the cavities from maternal vessels returns by *maternal* vessels, and the fetal blood in the chorial villi comes and returns by *fetal* vessels.

The maternal blood cavities are variously known as *lacunæ* (lakes), sinuses, and "intervillous spaces," because they occupy the spaces between neighboring villi. The mode of their formation is not absolutely settled; two explanations are given. One is that the maternal capillaries themselves dilate into large sinuses (we might think of them as normal varicose or aneurismal dilatations) into which the growing villi project. The other is that in the thick layer of trophoblast covering the villi, patches of degeneration occur in the trophoblast cells, thus leaving empty spaces into which maternal blood gains admittance, by the phagocytic cells of the trophoblastic syncytium having *eaten their way* into the walls of maternal bloodvessels, thus permitting an actual extravasation or hemorrhage into the spaces whence the trophoblast cells have disappeared. The blood thus coming into the spaces, goes out again by other openings made by the same phagocytic action of the trophoblastic cells. In some instances the tropho-

blast completely *surrounds* the blood space (sinus), and then eats away the maternal wall enclosing it, thus the blood that was enclosed by and in contact with a *maternal* vascular wall is now enclosed by and in contact with a *fetal* wall; viz., trophoblast, or chorionic ectoderm. Having consumed the wall of the sinus, the hungry trophoblastic cells probably proceed to consume the blood itself, but they cannot consume it all, for the supply is constantly renewed by the circulation. Projecting into these ponds of maternal blood come the stems and branches of chorial villi with their loops of capillary vessels. Fig. 45

FIG. 45.



Vertical section of a placenta, showing vascular tufts of chorion and blood lakes of placenta. *a, a.* Chorion. *b, b.* Decidua. *c, c, c, c.* Orifices of uterine sinuses.

—an old diagram from Dalton—shows very well the plan of construction described, the black shading represents the pond of maternal blood which comes and goes through the openings *c, c, c, c.* Observe that the terminal ends of some of the villi join the decidua, these are known as “fastening villi”; others dangle free in the intervillous spaces without any such fastening. Note, too, that between the fetal and maternal blood

there always exists the structure of the villus itself, which, though extremely thin, still consists of the endothelium lining the fetal capillaries, and the ectodermal layer of trophoblast covering them. Through these structures the interchange of material, including oxygen and carbon dioxide, takes place by osmosis.

As the villi branch out, enlarge, and communicate with each other, their phagocytic covering of trophoblastic ectodermal cells has continued to consume and absorb the uterine tissues of the serotina, so that eventually nearly the whole placenta consists of fetal villi and maternal blood spaces, with their contained maternal blood. Some strands of the interglandular tissue of the serotina, however, always persist, and extending from the thin basal layer next the muscular coat to the stratum compactum facing the uterine cavity, they constitute the fibrous bands, or septa, which divide the placenta into lobular areas, seen on its uterine surface after delivery.

Our knowledge of the complete placenta has been acquired by direct observation, but during the early days of placental development very few human ova have been seen. The youngest yet known was described by H. Peters in 1899. It is thought to have been from three to six days old. Sections of this specimen appear in all our recent text-books, but no two of them are exactly alike. I have ventured to introduce a reconstructed illustration, Plate II, which is a sort of composite modification of those given by Minot, Williams, Robinson, and others, which I hope will be understood. The entoderm, mesoderm, and ectoderm have the same green, red, and black coloring, respectively, as in Plate 1.

To agree with this plate, I have taken the rather unwarrantable liberty of lining the amniotic cavity with ectodermal cells continuous with the back of the embryonic shield; but the more highly magnified Fig. 46, immediately following, shows this to be untrue. The fact is, this early human specimen differs from, and cannot be made to agree with, the conditions observed in other animals on which our knowledge is based, as will be explained farther on.

Another early human ovum is that of Graf Spee, shown in Fig. 47, a section of which appears in Fig. 48.

In these and all other specimens of early *human* ova, the amnion is always seen as a sac *already closed*, so that we know

DESCRIPTION OF PLATE II (PETERS' OVUM).

Ent. (green). Entoderm.

Mes. (red). Mesoderm.

Ec. (black). Ectoderm.

Clot. Blood clot covering space between *A* and *B*, where ovum penetrated the uterine epithelium (by phagocytic action of trophoblast) and entered beneath decidua vera.

Bl. lac. Blood lacunæ.

Tro. Trophoblast.

Ut. ep. Uterine epithelium.

Yk. Yolk (vitellus).

Mus. Muscular wall of uterus.

Conn. Connective tissue.

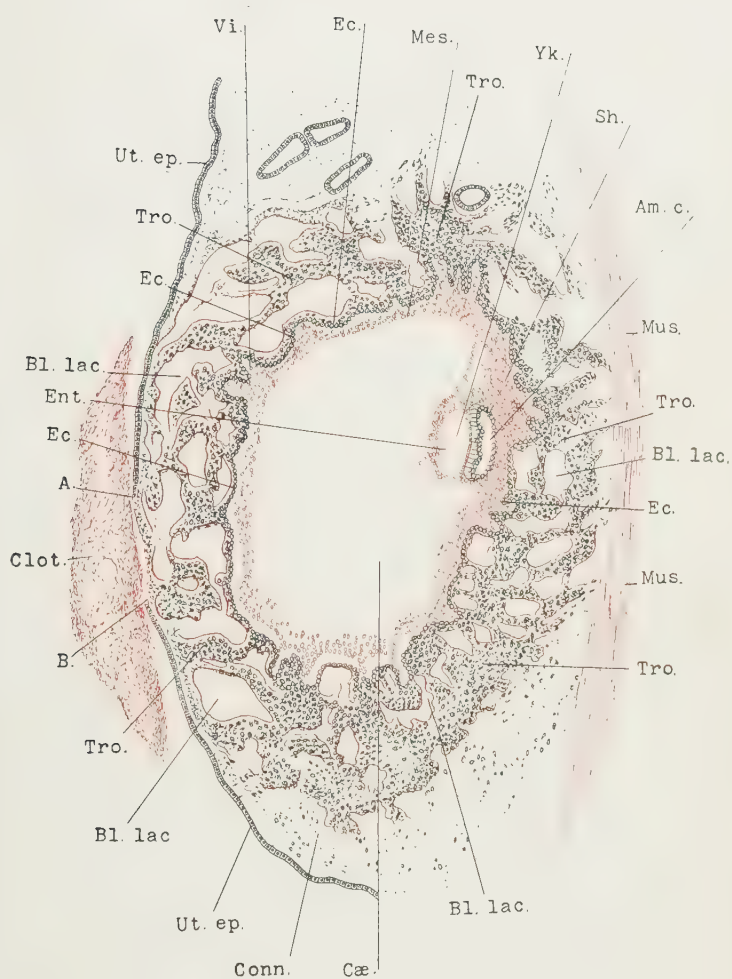
Cæ. Cælum, or body cavity.

Sh. Embryonic shield.

Am. c. Amniotic cavity.

Vi. Chorionic villi. At the top of the plate appear transverse sections of four utricular glands, lined by uterine epithelium.

PLATE II.



nothing as to the mode of its formation, but, as Ballantyne remarks, "the fact of its being closed suggests the question whether it was ever open. Probably the amnion in the human subject is NOT formed by the upheaval of folds of extra-embryonic somatopleure at all, but by breaking down of epiblast tissue to form a cavity (Berry Hart), or by inversion of the blastoderm (Mall)." In Mall's early ovum the amniotic sac appeared before any embryo or primitive trace could be discovered.

FIG. 46.

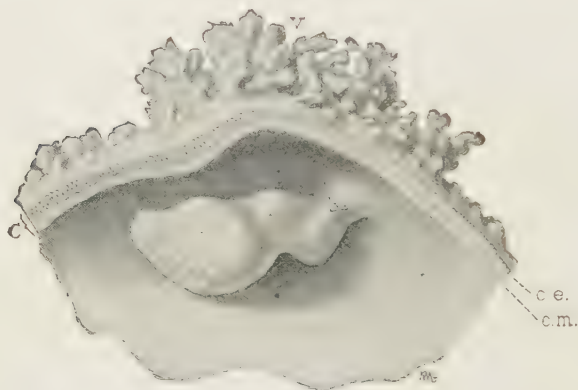


Portion of Peters' ovum, highly magnified, showing early stage in development of embryo. (After WILLIAMS.) A. Amnion. C. Chorion. ect. Ectoderm. ent. Entoderm. mes. Mesoderm. E.S. Embryonic shield. Y.S. Yolk-sac. Sp. Portion of coelum.

Reichert's ovum, supposed to be thirteen days old, and represented four times its natural size in Figs. 49 and 50, was found in the womb of a woman who committed suicide. It was flattened from side to side, somewhat like a biconvex lens,

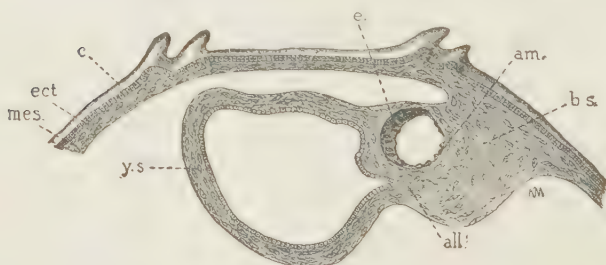
the surface facing the reflexa (shown in Fig. 50) being more convex than the other. Fringes of villi projected only from its borders, the central portions of both surfaces being bald and

Fig. 47.



Spee's human ovum, embryonic area, 0.4 millimetre long. $\times 24$. (WILLIAMS.)
A. Amnion. *Bs.* Abdominal pedicle. *C.* Chorion. *c. e.* Chorionic epithelium, *c. m.* Chorionic mesoderm. *V.* Chorionic villi. *Y.* Yolk-sac.

Fig. 48.



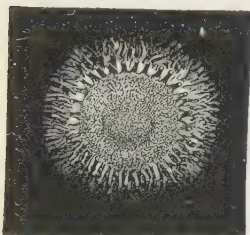
Section through Spee's youngest ovum, shown in Fig. 47. $\times 24$. (WILLIAMS.)
c. Chorionic membrane. *ect.* Ectoderm. *mes.* Mesoderm. *am.* Amnion. *e.* Beginning embryo. *bs.* Abdominal pedicle. *all.* Allantois. *y.s.* Yolk-sac.

circular, that toward the uterus exhibiting also a smaller circular central space. It contained no trace of a foetus. A

human ovum, fourteen days old, with embryo, magnified twenty diameters, and obtained by His, is shown in Fig. 52, p. 106, and another between fifteen and eighteen days, described by Coste, is shown, largely magnified, in Fig. 53, p. 106.

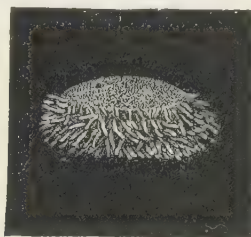
Disappointing as it is to find these differences between early human ova and the ideas we have obtained from the study of

FIG. 49.



Showing front view of Reichert's embryo. $\times 4$.

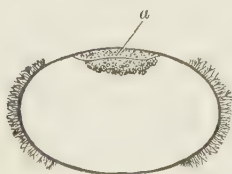
FIG. 50.



Showing side view of Reichert's ovum. $\times 4$.

other animals, it is gratifying to know that the final outcome is the same; that is to say, whatever the beginning, in the end the placenta and membranes come out as we have described them. With the student I deplore these discrepancies, but he will understand that, with regard to them, the rest of the

FIG. 51.

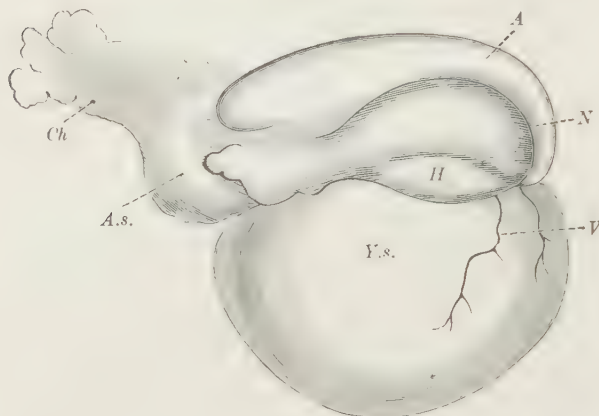


The same in diagrammatic section. (His.) $\times 5$. *a*. Area germinativa.

obstetrical world is no better off than we are. To remedy the difficulty we must await more specimens and further investigation.

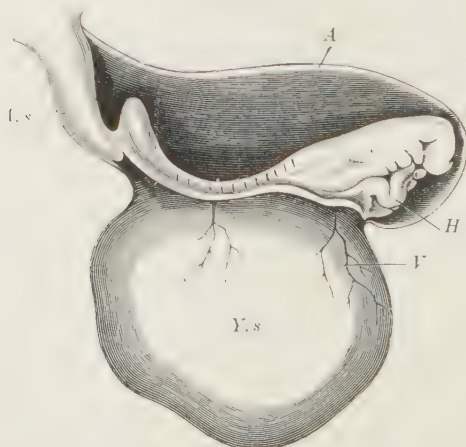
The Placenta at Full Term.—The placenta at full term is a soft, spongy mass, irregularly saucer-shaped, seven or eight inches in diameter, three-quarters of an inch thick near the centre, and from one-eighth to one-fourth at the edge;

FIG. 52.



His's ovum, seen from right side. $\times 20$. *A.* Amnion. *A.s.* Allantois connecting with *Ch.*, a part of the chorion. *H.* Heart. *V.* Bloodvessels of *Y.s.*, yolk-sac, or umbilical vesicle. *N.* Neural groove for spinal canal.

FIG. 53.



Human ovum during third week. *A.* Amnion. *A.s.* Allantoic stalk. *H.* Heart. *V.* Bloodvessels of *Y.s.*, the yolk sac, or umbilical vesicle. (From His, after COSTE.)

average weight twenty ounces. It varies much in all these particulars.

On inspection after delivery, the uterine or external surface presents a dark-red, rough, and uneven appearance, with irregular fissures dividing it into lobes, as seen in Fig. 54.

FIG. 54.

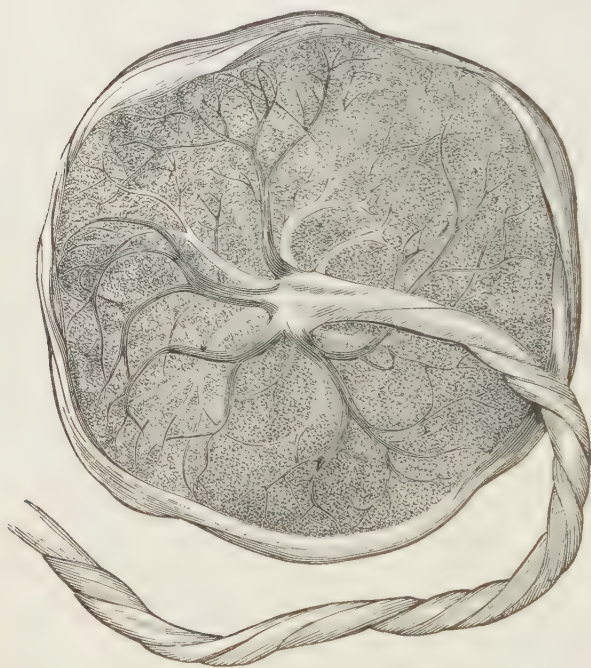


Uterine surface of the placenta.

The internal or foetal surface is smooth and glistening, while large bloodvessels may be seen and felt beneath its amniotic covering, as shown in Fig. 55. The placenta is usually *situated* on the posterior wall of the uterus, high up near the entrances of the Fallopian tubes. This is the rule; exceptionally, there is no part of the uterus to which it may not be attached.

So far as I am aware, no one has suggested how the blood is forced into and out of the uterine blood-spaces, except, of course, by the presupposed *vis a tergo* from the mother's heart. The blood-spaces are lined by fetal ectoderm and lack the *muscular coat* found in arteries. It is, therefore, conceivable

FIG. 55.



Fœtal surface of the placenta.

that the circulation in them is aided by the intermittent *contractions of the uterus*, which must corrugate and draw together the walls of the placental sinuses, so as to partially empty them. They fill up again when the contractions cease; thus, the uterine contractions act as an auxiliary heart for the inter-villous circulation. This is my own idea—it may be erroneous.

The Umbilical Cord (Navel-string, Funis).—At first it is the root of the allantois, or that portion of the allantois extending from the body of the fœtus to the chorion. Later it remains the connecting link between the abdomen (navel) of the fœtus and the placenta. It contains two arteries, which are continuations of the fœtal hypogastric arteries, and one vein—the latter without valves, although crescentic-shaped folds occluding two-thirds of the canal of the vein, and thus constituting imperfect valves, have been described. The umbilical arteries, at first straight, become, later, twisted around the vein. The vessels are imbedded in the so-called gelatin of Wharton, and the cord is covered externally by a special layer of epithelium derived from the fœtal ectoderm, and *not* by a sheath of amnion as was formerly supposed. (See page 95).

The cord is usually attached *near*, but not exactly *in*, the middle of the placenta. Sometimes it is inserted close to the placental margin, and is called then “battledore placenta” and “*insertio marginalis*.” Very rarely it is inserted outside the placental border, into the membranes, the umbilical vessels subdividing and spreading out their branches before reaching the placenta—“*insertio velamentosa*.”

NUTRITION OF FÆTUS AT DIFFERENT PERIODS OF PREGNANCY.

1. At first the ovum absorbs nutriment simply through the vitelline membrane, while passing through the Fallopian tube. The nutrient material is supplied by the secretion of the tube itself, or may consist in part of seminal fluid introduced from without.

2. The vitellus is absorbed by the entoderm lining the umbilical vesicle and alimentary canal, and later it is absorbed and conveyed into the body of the embryo by the bloodvessels of the area vasculosa.

3. When the contents of the umbilical vesicle are exhausted, the chorial villi appear and take up nourishment from the uterine decidua, with which they are in contact.

4. With the disappearance of villi in the chorion layer, the villi of the decidua serotina develop into the placenta, where

they take up nutriment from the maternal blood with which they are surrounded.

Functions of the Placenta.—It not only *affords nutriment* to the child, but is also its *respiratory organ*. The umbilical arteries carry blue venous blood to the placenta, where carbonic acid gas is given off to the maternal blood, and oxygen taken in from it, so that the umbilical vein brings back arterial (red) blood to the fœtus. The placenta is also an *organ of excretion* for the infant. Recently the placenta has been credited with a *selective* function, by which it has power to select from the maternal blood such materials as may be required by the fœtus at different periods of pregnancy.

Fœtal Circulation.—The umbilical vein after entering the umbilicus sends two branches to the liver, while its main trunk (the *ductus venosus*) empties directly into the ascending vena cava. The blood returned from the placenta by the umbilical vein goes, therefore, part of it to the liver, whence it is returned by the hepatic veins into the ascending vena cava just above the entrance of the ductus venosus to join the current from this latter vessel. The blood from the lower extremities of the fœtus comes up through the vena cava, and thus mixes with the return blood from the placenta.

Early in pregnancy the greater part of the blood in the umbilical vein goes through the liver, but toward the end of pregnancy the bulk of it goes directly into the ascending vena cava through the ductus venosus, the duct having become enlarged for this purpose while the portal system has become insufficient to transmit the increased quantity of blood.

The ascending vena cava pours its blood into the right auricle of the heart, whence it is directed by the Eustachian valve through the *foramen ovale* into the left auricle. From the left auricle it goes to the left ventricle; from the left ventricle to the aorta. The great bulk of this aortic stream passes through the large arterial branches of the aortic arch to the head and upper extremities. From these the blood returns by the descending vena cava to the right auricle; from thence through the tricuspid valve it passes into the right ventricle; and then it enters the beginning of the pulmonary artery, but the two branches of the pulmonary artery going to the lungs cannot receive this column of blood before respiration is established, so that there is a special blood-duct

(the *ductus arteriosus*) provided for carrying the stream from the trunk of the pulmonary artery into the descending aorta, from whence part goes to the lower extremities, to come back by the ascending cava, while another portion passes along the umbilical arteries to the placenta. The umbilical arteries are continuations of the hypogastric arteries given off from the internal iliaes.

Changes Taking Place in the Circulation after Birth.

There is no longer any current of blood through the umbilical vessels. The navel string dries up and falls off. The umbilical arteries *inside* the abdomen remain permanent in a part of their course, constituting the *superior vesical arteries*. The ductus venosus and ductus arteriosus no longer admit blood, but shrivel up into fibrous cords. The foramen ovale closes, so that there is no longer any passage from one auricle to the other, and when the lungs are expanded by respiration the pulmonary arteries receive the blood which before went through the ductus arteriosus, and convey it to the lungs.

Appearance of the Embryo at Different Periods.—Since it may be important to ascertain the probable duration of pregnancy when the product of conception has been prematurely discharged, we conclude this chapter with a brief reference to the size and appearance of the growing ovum at different periods.

For the first two weeks after fecundation the ovum is simply called an *ovum*. From the end of the second week until the end of the *fifth*, it is called an *embryo*. From the end of the fifth week until full term it is called a *fetus*. But this rule is not rigidly followed in the books. As we have seen, the germ-cell lives in the ovary years before impregnation. Bal-lantyne calls this the "*germinal period*" of its life.

At first the developing embryo is composed almost entirely of *water*. The analyses of Fehling and Michel give the percentage of water at two and a half months as 93.82; from third to fourth month 89.95; and at seventh month 84.75, the remaining constituents being albuminoids, salts, and fats (Williams).

The different membranes with their cavities filled by watery fluids would suggest our regarding the early embryo as a sort of complicated *system of cysts*, and such it really is. It contains no vacuum and no air-cavity: *all* spaces are occupied

by a watery fluid of some sort ; the fluids of different cavities probably differing in density and in their chemical and electrical properties, not yet ascertained.

It may be noted that in all the sections of early embryos—of whatever animal—represented in the books, the *dorsal* surface of the embryonic body is *always* directed toward the uterine wall, toward the *decidua serotina*. When the folds of the amnion arch over the back of the embryo, meet, unite, and separate into amnion and chorion, the back of the embryonic body becomes cut off—as we have seen, page 91—from its junction with the uterus at all points except the body stalk ; thus it can no longer maintain its original parallelism with the uterine surface, but the head and body of the embryo, suspended only by the caudal body stalk, change their relative position in such a manner as to bring the *abdominal* aspect of the embryo toward that part of the uterine surface toward which the *back* was originally directed ; that is to say, the navel, with its yet short umbilical cord, faces the uterine surface : originally the *back* faced in this direction. Whether this change be due to gravity or other causes is not determined, though the curving forward of the caudal end of the embryo during the third week undoubtedly contributes to bring the body stalk more to the front : a process which becomes still more pronounced during the fourth week, when the caudal and cephalic ends of the embryo approach each other, something like the two ends of a capital C.

During the third week, however, the embryo presents a remarkable “dorsal flexure” in the *opposite direction*, sharply convex in front with a corresponding sharp sulcus in the back. This completely disappears during the fourth week, when the rudimentary spinal column becomes continuously rounded and convex posteriorly, as we find it later in the fœtus. This forward “dorsal flexure” of the third week is thought to be abnormal, or accidentally produced during examination of the specimens in which it has been observed, a point as yet unsettled.

Size of Embryo and Fœtus. There are different ways of measuring the embryo. When the “*dorsal flexure*” has disappeared, the forward longitudinal flexion of the embryonic body becomes so pronounced as to bring the head and tail ends almost in contact, thus producing a decided hump just

behind the head, known as the "neck-bend," which reaches its extreme development about the end of the fourth week, after which it diminishes as the body lengthens and the head and tail recede from each other.

The measurements of Prof. His (quoted in most books) extend from the neck-bend to the caudal-bend. (See Fig. 56.)

Measured by His's method (from neck-bend to caudal-bend) the length at different periods is about as given in Fig. 56.

Prof. Minot disregards the neck-bend and measures "the greatest length of the embryo in a natural attitude along a straight line," the limbs *not* to be included.

Since embryos of the same age differ much in length, an *exact* standard of measurement is unattainable and unnecessary.

Measured by Minot's method the length of the embryo at the *end* of

4 weeks is	1 cm., about $\frac{3}{8}$ inch.
8 weeks is	$2\frac{1}{2}$ cm., about 1 inch.
12 weeks is	8 cm., about $3\frac{1}{4}$ inches.
16 weeks is	$15\frac{1}{2}$ cm., about $6\frac{1}{8}$ inches.

Haase suggests the following rule: During *first* half of pregnancy, squaring the number of the month gives the length in centimetres. During *second* half, multiplying the number of the month by *five* gives the length in centimetres. It gives approximate results as shown in the following table:

End of first month,	$1 \times 1 = 1$ cm., about $\frac{3}{8}$ inch.
End of second month,	$2 \times 2 = 4$ cm., about $1\frac{1}{8}$ inches.
End of third month,	$3 \times 3 = 9$ cm., about $3\frac{1}{4}$ inches.
End of fourth month,	$4 \times 4 = 16$ cm., about $6\frac{1}{4}$ inches.
End of fifth month,	$5 \times 5 = 25$ cm., about $9\frac{1}{4}$ inches.
End of sixth month,	$6 \times 5 = 30$ cm., about $11\frac{7}{8}$ inches.
End of seventh month,	$7 \times 5 = 35$ cm., about $13\frac{3}{4}$ inches.
End of eighth month,	$8 \times 5 = 40$ cm., about $15\frac{3}{4}$ inches.
End of ninth month,	$9 \times 5 = 45$ cm., about $17\frac{3}{4}$ inches.
End of tenth month,	$10 \times 5 = 50$ cm., about $19\frac{3}{4}$ inches.

The measures in this table during the later months are supposed to extend from the top of the head to the soles of the feet.

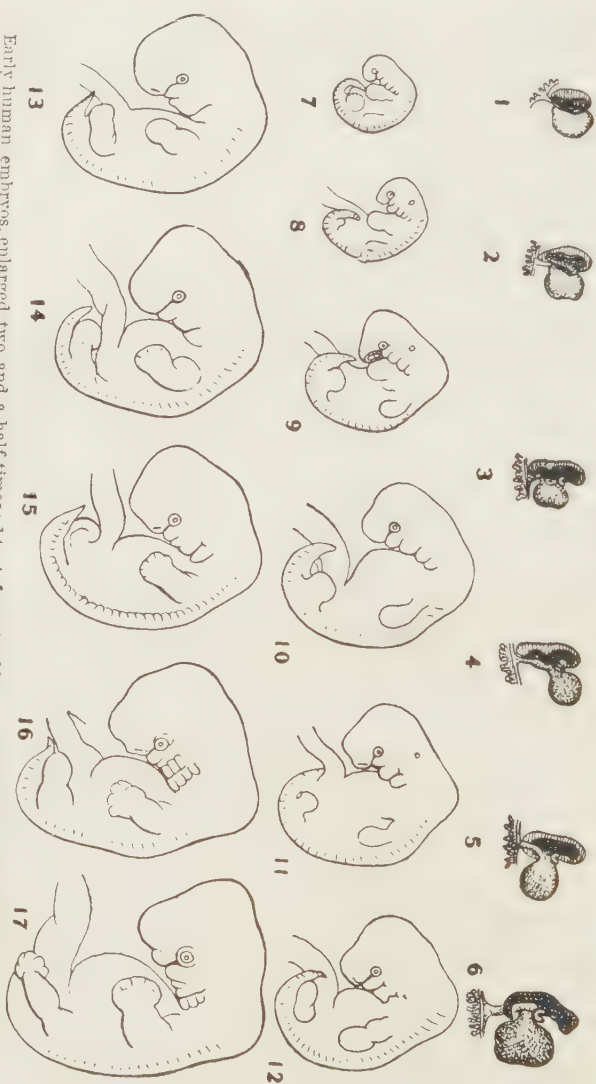
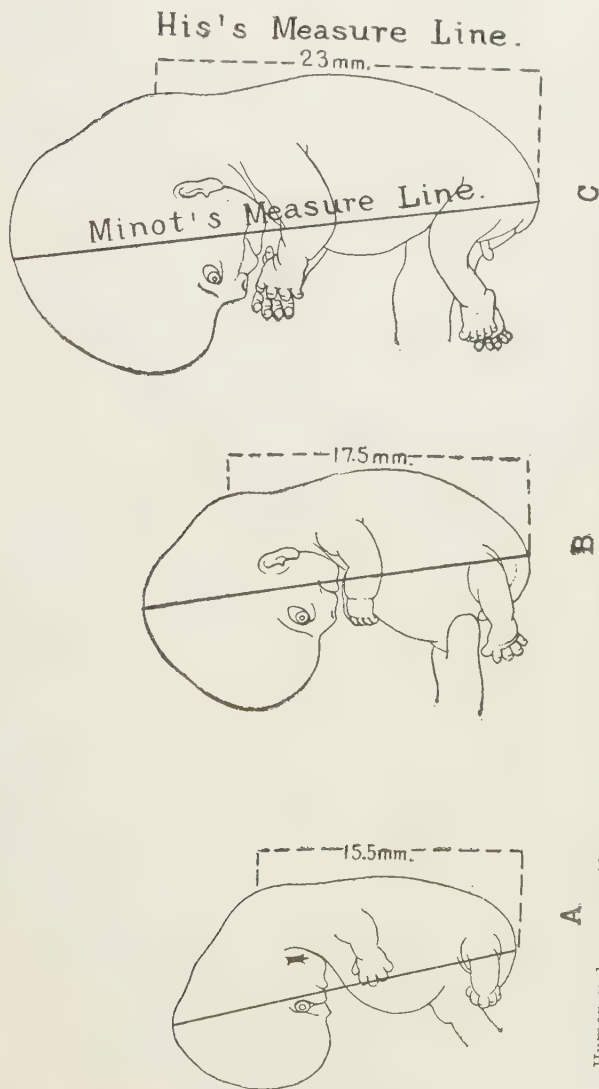


FIG. 56.

Early human embryos, enlarged two and a half times: 1 to 4, from twelfth to fifteenth day; 5 and 6, from eighteenth to twenty-first day; 7 to 12, from twenty-third to thirtieth day; 13 to 17, from thirty-first to thirty-fourth day. (Modified from DORLAND, after HIS.)

FIG. 57.



Human embryos magnified two diameters, from beginning to end of second month. (Modified from WILLIAMS, after His.)

The child at full term measures in this way (when the lower limbs are extended) on an *average* about 20 inches. Its average weight is 7 pounds. Quite healthy children at full term may weigh only 6, or even 5 pounds. Below 5 there is usually some abnormality; on the other hand, children of 10 or 12 pounds are not *very* unusual; those of 20 pounds and upward are extremely rare.

CHAPTER VII.

THE SIGNS OF PREGNANCY.

THE signs of pregnancy require particular and careful study, for several reasons :

(1) Because unskilled persons very often, and the most skilful physicians sometimes, make mistakes in stating that pregnancy exists when it does not, or *vice versa*. (2) The question of pregnancy may involve character, as in unmarried females. (3) It may involve the legal rights of offspring. (4) It determines medical, surgical, and obstetrical procedures often of the gravest import. (5) It concerns the reputation of the physician ; his errors subject him to ridicule.

Classification of Signs.—They have been divided into *presumptive*, *probable*, and *positive*, according to the degree of reliance to be placed in them as evidence of pregnancy. They have also been called *rational*, or such as are evident to the sensations of the patient ; and *physical*, such as become apparent to the educated physician by physical examination. Probably the most practically useful method is to divide them into those that *are* certain and those that *are not* : hence, *first, Positive signs ; second, Doubtful signs.*

The duration of pregnancy in the human female is forty weeks, or two hundred and eighty days, or ten months. In using the term “month” in this work it will be understood to mean a lunar month of twenty-eight days.

How Early during This Period is it Usually Possible to Make a Positive Diagnosis of Pregnancy in Doubtful Cases Where Important Interests Are Involved ?—It cannot be far from true to assert that the majority of general practitioners of medicine are not sufficiently skilful to make a positive diagnosis in such cases before the pregnancy is nearly half over. Even the most skilful can hardly obtain absolutely positive signs during the first sixteen weeks.

But little reliance can be placed upon the statements of the woman herself. Without being consciously untruthful, she may be deceived by her own sensations; and in other cases may wilfully mislead the examiner, even denying the *possibility* of pregnancy almost up to the time of delivery.

POSITIVE SIGNS.

There are only *four* signs that are *absolutely* positive, viz.:

1. The fœtal heart sound.
2. Quickening, or active motions of the child.
3. Ballottement, or passive locomotion of the child.
4. Recognition of fœtal parts by abdominal palpation.

Three others, though not so valuable, are usually classed with the positive signs, viz.:

5. The uterine murmur.
6. Intermittent contractions of the uterus.
7. Hegar's sign.

1. **The Fœtal Heart Sound.**—The pulsation of the heart can seldom be heard before the twentieth week (the middle of pregnancy). A practised, skilful ear *may* recognize it two or three weeks earlier. As pregnancy advances the sound gets louder and more easy of recognition, resembling that made by the ticking of a watch heard through a feather pillow. A good imitation of it may be produced by pressing the palm of one hand strongly against the ear, while on the back or cubital border of it a series of gentle touches, in quick succession, are made with the tip of the middle finger of the other hand, previously moistened with saliva: or a beginner may learn the sound by listening to the heart of a new-born child.

Failure to hear the heart sounds during the later months does not positively negative the existence of pregnancy, for the child may be dead; or the heart sounds may be very feeble; or thick tumors, etc., may intervene between the uterine and abdominal walls, interfering with the transmission of the sound; or the auscultator's ear or skill may be at fault.

The *frequency* of the fœtal heart sounds bears no relation with that of the mother's heart. They are independent of each other. The fœtal heart beats from one hundred and thirty to one hundred and fifty times a minute. It is generally a little less frequent in large children than in small ones. Very large

children are usually males. Hence, attempts have been made to determine the sex before birth by the heart sounds, but little reliance can be placed in the method.

It is barely possible to mistake the sound of the mother's heart for that of a child in utero, as when, *ex. gr.*, the mother's heart, from fever or other cause, attains the same frequency as that of the infant; but this mistake could be avoided by noting if the mother's pulse beat *simultaneously* with the abdominal sounds.

When the sounds of the pulsations of the fœtal heart are distinctly heard, while the womb is found too small to contain a fœtus of sufficient size to yield a heart sound, and especially if the womb be but little larger than an unimpregnated one, it indicates *extra-uterine* fœtation.

Method of Examination.—Owing to the flexed posture of the child, the sign is transmitted through its *back*, which is in closer contact with the uterine wall than are the other parts of the infant's thorax. The back of the child usually lies against the lower part of the uterine wall on the left side. We listen for the sound, therefore, on the abdomen of the mother about the middle of a line drawn from the umbilicus to the centre of Poupart's ligament on the left side, or the region thereabouts. Failing to hear the sound there, the same region on the right side may be examined, and, if again failing, the whole surface of the abdomen may be explored. The sound may be rendered more distinct by pressing the palm of the hand on that part of the uterus opposite the child's back, so as to force the dorsal aspect of the infant against the side of the uterus to which the ear or stethoscope is applied.

In breech presentation the sound is heard above the umbilicus, and in transverse cases low down near the symphysis pubis.

Before the last three months of pregnancy we may hear the sound better over the median line in some cases.

In auscultation of the abdomen a stethoscope is used (the double one preferred), or the ear alone, one thin layer of clothing covering the surface in the latter method for the sake of delicacy. For various reasons the stethoscope is better. The patient must lie upon her back, her limbs extended or moderately flexed, and the room be kept quiet. Feeble sounds

are sometimes diverted by the fingers on the stethoscope. By wetting the mouth of the instrument, so that it will stick to the skin, it may be held in position by the head of the examiner while the fingers are removed.

2. **Quickening.**—This term *originated* from the erroneous supposition that the child became "*quick*," or alive, only after it began to move. It simply *means* active muscular motions of the child's limbs or body. The period at which fetal movements may be first recognized varies very much; but to make a practical statement, and one easy of recollection, we may say *about the middle of pregnancy*. Then, and after then, an obstetrician of ordinary skill may feel the motions of the child, but the mother may be cognizant of certain sensations in the abdomen (described as "fluttering," "pulsating," "creeping," etc.), which she calls "feeling life," as early as the sixteenth or eighteenth week. Occasionally in examining the abdomen the physician, at this early period, or even before, may feel, or hear with the stethoscope, certain motions, which he *supposes* are fetal movements, but these are scarcely reliable.

Late in pregnancy the motions, when violent, produce distortions and projections of the abdominal wall that may be *seen* as well as felt.

The motions are of two kinds, viz.: a slow, diffused, heaving motion produced by movements of the child's body; and more forcible quick motions produced by movements of its limbs.

Failure to recognize these movements does NOT negative the existence of pregnancy: the child may be dead, or it may retain life and vigor, and yet fail to move, even during the physician's examination.

Contractile muscular motions in the abdominal, uterine, or intestinal walls, the movement of gas in the intestinal canal, and the pulsations of aneurisms and large arteries, may, it is just possible, be mistaken for fetal movements by the inexperienced.

Method of Examination.—Late in pregnancy fetal motions may often be discovered while the woman is standing or sitting, but it is best to place her on her back, with the thighs flexed, so as to relax the abdominal wall. *All* clothing, especially corsets and waistbands, should be removed from the entire

abdomen. The bladder and rectum must be empty. Place the woman near the side of the bed, and let the examiner stand close to *her* side, but facing her feet; his hands to be placed, palms together, as shown in Fig. 58, their ulnar borders being gradually separated and pressed down on each side of the uterus until that organ is held between them. One hand should now remain still while the other manipulates the womb, feeling for any inequalities or projections produced by

FIG. 58.

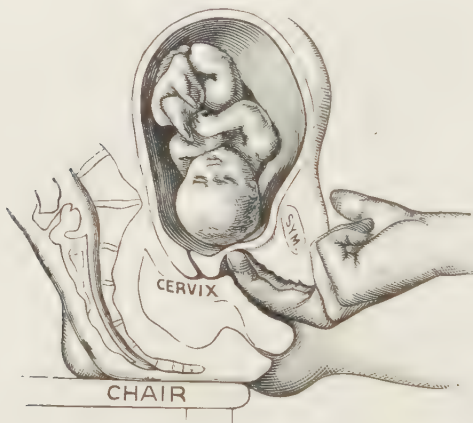


the foetus. Pressure thus applied, first on one side, then on the other, will usually cause foetal motions, during which *both* hands should be held still, thus enabling the examiner to distinguish between active movements of the child itself and passive movements produced by his own manipulation.

3. **Ballottement**—**Passive Locomotion of the Foetus**.—This is a sudden locomotion of the child in the uterine cavity, *produced* and felt by the physician.

Method of Examination.—The woman is placed in a position which will make the child settle, by gravitation, toward that part of the uterus where the examining finger is to be applied *per vaginam*. The best plan is to let her sit on the edge of a low bed or chair and then lean back against pillows, so as to be midway between sitting and lying. The finger is now introduced and placed in front of the cervix, close to its junction with the body of the womb. (See Fig. 59.)

FIG. 59.



Internal ballottement, semi-recumbent position, at sixth month. (JEWETT.)

The other hand steadies the fundus uteri. A sudden upward, jerking, but not violent motion is now executed by the examining finger, which will cause the fœtus to bound slowly upward to the fundus, and as it comes back again the finger will feel it knock against the neck (so to speak) of the uterine bottle in which it floats. The manipulations may be repeated several times to insure certainty. The position may be changed to a lying or standing one, and the finger put behind the cervix uteri, if the first examination be not satisfactory.

The standing position—the woman placing one foot on the lower round of a chair and the examiner kneeling in front of her though indelicate, should always be tried when we fail to recognize ballottement in other postures.

If the abdominal walls be thin, *external ballottement* may be performed. The woman lies on her side, the abdomen slightly over the edge of the bed, and with a hand on each side of the womb the operator endeavors to move the fetus up and down for the purpose already indicated, or he may apply his hands to the womb in the manner just previously described for discovering fetal movements—the woman lying upon her back, when, by gentle tapping with the finger-tips, the bound and rebound of the floating fetus may be perceived.

Ballottement may be recognized earlier than any other of the positive signs, viz., from about the fourteenth or fifteenth week, and until within six or eight weeks of full term.

Toward the end of pregnancy the child so nearly fills the uterine cavity that it cannot be moved about. In multiple pregnancies, or where there is deficiency of the liquor amnii, the sign is unavailable for the same reason. The child may also be immovable when it is lying crosswise in the womb. Again, the operator may lack skill and acute tactile sensibility. During the first part of pregnancy the child is too light in weight to be felt with the finger through the uterine wall.

A calculus in the bladder, a pediculated subperitoneal fibroid tumor of the uterus, a prolapsed and slightly enlarged ovary, and a multilocular ovarian cyst may give results resembling ballottement, but they are found to be *outside* of the uterus—not *in* it—as may be discovered by the bimanual examination.

4. Recognition of Fœtal Parts by Abdominal Palpation.—

During the later months of pregnancy the head, breech, back, and movable small parts of the child may be recognized by palpation (see p. 244), when the conditions for so doing are favorable; but caution must be taken not to mistake fibroid tumors of the uterus for the child's head and pediculated subperitoneal tumors for the movable small parts.

It may here be added that a positive diagnosis of pregnancy during the later months is possible from skiagrams made with the Röntgen rays.

5. **The Uterine Murmur.**—This has been called *placental murmur*—*placental souffle*, or *bruit placentaire*—because it was thought to be produced by blood rushing through the “placental sinuses”; *uterine souffle* or murmur, on the supposition of its being caused in the same way in the arteries of

the uterus; *abdominal souffle*, because it was believed to occur from pressure of the gravid womb upon the large vessels of the abdomen. It has also been referred to blood-changes, like those occurring in profound anemia, and it is said a somewhat similar sound has been produced by pressure of the stethoscope upon the epigastric artery in the abdominal wall.

These theories are still unsettled. The one most generally received is that which refers the sound to the *uterine* blood-channels. The murmur has been heard several days after complete delivery of the placenta, and there is no substantial proof of its production in the vessels of the abdomen.

The most striking peculiarities of the uterine murmur are as follows:

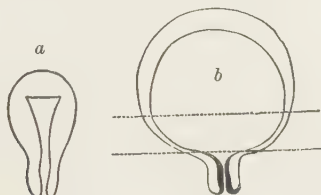
1. It is a maternal sound synchronous with the mother's pulse.
2. It is remarkably capricious or coquettish in character, changing often in tone, pitch, intensity, duration, and location, even while we listen, or it may be absent and again return.
3. It becomes stronger at the beginning of a labor pain, ceases altogether at the acme of the pain, returns loud again as the pain goes off, and, after that, resumes the character it had before the pain began.

It is most usually recognized near the lower part of the abdomen, and necessarily so when first audible, because the womb does not yet extend high up in the abdominal cavity. Toward the end of the pregnancy it may be heard, of course, higher up. The stethoscope should be placed on the sides of the uterus, over the uterine arteries. It cannot generally be recognized before the *sixteenth week*, except by ears exceptionally acute and skilled. It remains afterward till full term, unless temporarily absent, as before explained. It is not an *absolutely* positive sign of pregnancy, because a sound resembling it may be heard in large fibroid tumors of the uterus, ovarian tumors, and other conditions. In fact, this sound never ought to have been classed with the positive signs. As years go by it is accorded less and less value.

6. Intermittent Uterine Contractions.—From about the twelfth week of pregnancy (when the womb has grown sufficiently large to be felt by the hand through abdominal wall) until its termination, the uterus is constantly contracting at intervals of a few minutes. Though a valuable sign, from the early period at which this may be recognized, it is not an

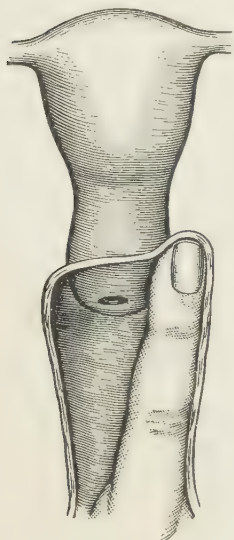
absolutely positive one, because the uterus may contract in a similar manner in its efforts to expel blood-clots, polypi,

FIG. 60.



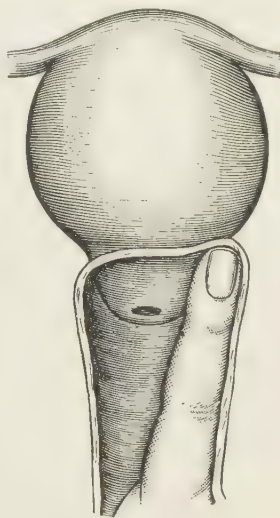
a. Pear-shaped virgin uterus. *b.* Jug-shaped uterus. The thinned segment is defined by the dotted lines. (Diagrammatic.)

FIG. 61.



Shape of non-pregnant uterus.
(From HIRST, after BUDIN.)

FIG. 62.



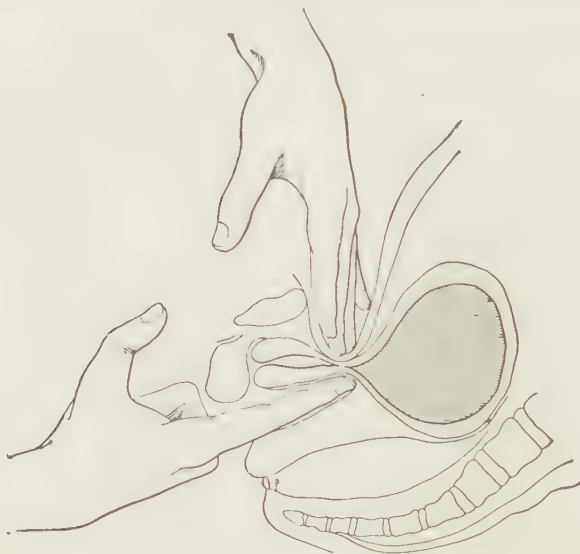
Shape of uterus in early pregnancy.

retained menses, fibroid tumors, and other products not connected with pregnancy. It is of great diagnostic value, however, as a corroborative sign when considered in relation with the history of the case.

The contractions of a distended bladder, when its walls are much thickened by hypertrophy, might possibly be mistaken for a contracting uterus. Emptying the bladder by a catheter would readily settle this difficulty.

Method of Examination.—Let one hand grasp the fundus uteri and remain so doing for from *five to fifteen or even twenty minutes*. It will feel the womb harden (by contraction) in a very characteristic manner. The contractions last from two to five minutes. Should the external examination alone fail to recognize the enlarged uterus, the bimanual method may be

FIG. 63.

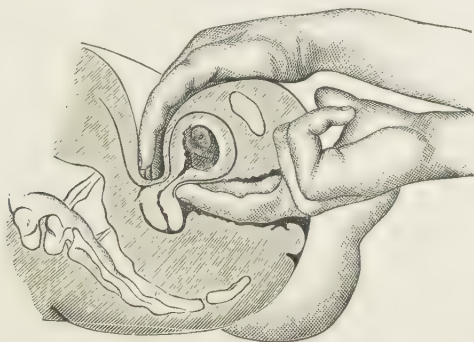


Demonstration of Hegar's sign by bimanual examination, the fundus being inclined backward. (SONNTAG.)

employed, one or two fingers of the other hand being passed into the vagina to elevate the uterus toward the hand already on the abdomen. It is of the greatest importance that the abdominal wall be relaxed by flexion of the lower limbs, the woman lying upon her back, and all clothing and waistbands removed.

7. **Hegar's Sign.**—This is a change in the *shape* and *consistency* of that part of the body of the uterus just above the cervix. The “pear shape” of the unimpregnated uterus is changed to that of an “old-fashioned, fat-bellied jug”; that is to say, the lower segment of the body of the uterus, instead of widening *gradually* above its junction with the cervix, widens *suddenly* like an inverted *round-shouldered* demijohn, the neck of which may be compared to the neck of the uterus. (See Fig. 60, page 125.) Together with change of *shape*, the segment of the uterine body immediately above the cervix (the round shoulder of our fat jug, to continue the simile) becomes *soft, thin, yielding, and elastic in consistency*, while above this yielding part there remains a harder, resisting portion of the uterine body.

FIG. 64.



Demonstration of Hegar's sign by bimanual examination at sixth week, the fundus being inclined forward. (JEWETT.)

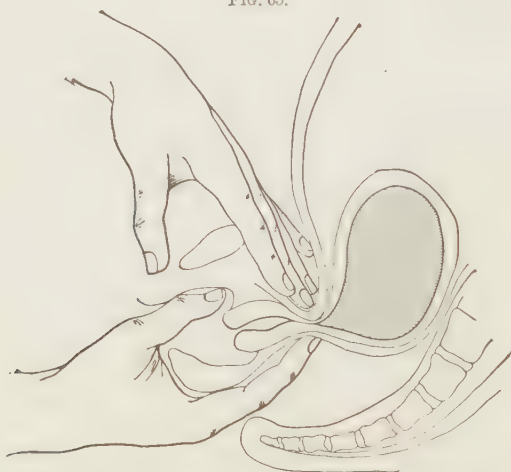
The change of shape, as recognized by the examining finger, is well shown in Figures 61 and 62, page 125.

Method of Examination.—If the vagina be spacious and the abdominal walls *lar and thin*, Hegar's sign may be demonstrated by passing the finger of one hand into the vagina high up behind the cervix uteri, while the finger-tips of the other hand make pressure externally above and behind the pubes, as shown in Fig. 63, page 126. In cases where the fundus uteri inclines forward, the intra-vaginal finger should go high

up *in front* of the cervix, while the fingers of the other hand make pressure externally *behind* the fundus, as shown in Fig. 64.

In cases (chiefly nulliparae) where the vagina is *not* sufficiently spacious and the abdominal walls *not* sufficiently lax and thin to allow of this demonstration by the method above described, let the index-finger of one hand be passed into the *rectum high up, above the attachment of the utero-sacral ligaments*, the thumb of the same hand going into the vagina in front of the cervix uteri, while the fingers of the other hand make pressure externally behind the pubes, as shown in Fig. 65.

FIG. 65.



Demonstration of Hegar's sign by recto-vaginal examination. (SONNTAG.)

Another method is to *press the whole uterus down* with the external hand, while the finger is in the rectum and the thumb in the vagina, as just stated. The tissues just above the internal os uteri may now be compressed between the thumb and finger, and their thinness and elasticity demonstrated. Sometimes the intervening tissues feel as "*thin as a visiting-card*," or the feeling may convey the impression of an apparent separation or loss of continuity between the cervix and body of the uterus.

Very rarely it may be necessary to anæsthetize the patient and draw down the uterus with a tenaculum or vulsellum forceps hooked into the vaginal portion of the cervix, in order to bring the thin portion of the uterine wall within reach of the examining fingers.

Hegar's sign has been recognized as early as the *sixth* or *eighth* week, and is of great value at this early date. In diseased conditions of the uterine wall it may be absent or unrecognizable, even though pregnancy exist. Some skilled observers assert that they have ventured a positive opinion from this sign as early as the *fifth* week, and which subsequently proved to be correct. The sign obtains more and more value in proportion to the *greater degree* of thinness and compressibility of the tissues concerned. When they can be so compressed as to yield the impression of an *apparent* separation between body and cervix the value of the sign is at its best. In a few instances this apparent separation has led to the erroneous diagnosis of extra-uterine pregnancy, especially where the cervix was hypertrophied, the enlarged cervix having been mistaken for the body of the uterus, while the enlarged body of the pregnant womb was taken for an extra-uterine cyst. A pre-existing lateral flexion of the uterus would increase the liability to such a mistake. Caution accordingly.

Nearly allied to Hegar's sign and often associated with it is the detection of *fluctuation* in the thin uterine segment, especially of the anterior wall. It is best recognized by passing *two* fingers into the vagina, and manipulating, first with one, then the other, while the womb is steadied by the remaining hand outside of the abdomen. It may be felt as early as seven or eight weeks, but requires an educated finger. The bladder should have been previously emptied by a catheter. It was first pointed out by Adolph Rasch. Sometimes the soft segment of the uterine *body* seems to overlap the *cervix* at the anterior fornix of the vagina, thus presenting a sort of ridge or fold easily felt by the examining finger.

Additional Physical Signs.—In addition to the foregoing seven positive signs, auscultation may reveal one or two others of less value. These are: 1. The *funic* or *umbilical souffle*—an intermittent, hissing sound, synchronous with the fetal heart, supposed to come from the umbilical arteries when the funis is coiled around the child's body or neck.

2. The "*fœtal shock*"—this conveys to the ear a combined sensation of shock and sound, and is probably produced by the pressure of the stethoscope moving the fœtus passively. It is *ballotement* recognized by the ear, instead of the *finger*.
 3. Sounds produced by *active* motions of the child. It is "*quickening*" recognized by the *ear*, instead of by the *hand*. This last is of some value, since it may be occasionally recognized earlier than the other auscultatory signs—viz., by the end of the twelfth week. Neither of these three additional signs, however, is comparable, in practical value, with the seven previously mentioned.

DOUBTFUL SIGNS OF PREGNANCY.

These are difficult to define numerically, but for convenience of recollection we may enumerate *five* that are easy of recognition and *five* others that are somewhat less so. Each of these ten signs, however, includes a variety of phenomena. They are as follows :

First Five.

1. Suppression of the menses.
2. Changes in the breasts and nipples.
3. Morning sickness.
4. Morbid longings and dyspepsia.
5. Changes in the size and shape of the abdomen.

Second Five.

6. Softening and enlargement of os and cervix uteri.
7. Violet color of vagina.
8. Irritability of the bladder.
9. Pigmentary deposits in the skin.
10. Mental and emotional phenomena.

Beside these there are a few residual odds and ends by which the list of gestation signals may be completed.

1. **Suppression of Menses.**—Menstruation is suppressed during pregnancy, because what would have been *menstrual* blood in the absence of impregnation is now appropriated to the development of the ovum and reproductive organs. There is no ovulation during pregnancy. Suppression of the menses

is a very doubtful sign, because, exceptionally, menstruation (and even ovulation) may occur during gestation. Cases are seen, *very* rarely, in which menstruation occurs *only* during pregnancy. Suppression of the menses may take place from cold, mental emotion, and many causes other than pregnancy. Again, the sign may be unavailable in cases where impregnation occurs at puberty, before the menstrual function is established; or during lactation, when it is absent; or in women whose menses are wanting from anæmia or debility. Finally, the woman herself may be untruthful, asserting that menstruation continues when it has ceased (or *vice versa*), and may even stain her napkins with blood to mislead her family.

When menstruation occurs during pregnancy it seldom recurs every month throughout the whole period; more frequently it ceases after the first three or four months. In the latter case the flow is *supposed* to come from that portion of the decidua vera with which the expanding decidua reflexa has not yet come in contact. After the contact named takes place, there is no further menstruation.

2. Changes in the Breasts and Nipples.—The *mammary glands* become firmer, larger, more movable; their blue veins more easily visible; and sensations of weight, pricking, tingling, etc., in them may be noticed by the patient. There are also a few light-colored silvery lines radiating over the projecting breasts.

The *nipples* become enlarged somewhat, and more distinctly prominent, or erect; and a sero-lactescent fluid oozing from them dries into branny scales upon their surface.

The *areola*, or disk, surrounding the nipple and the nipple itself gradually become darker in color, varying with the complexion of the individual from the lightest-brown tint to black. Upon the surface are seen ten, twelve, or more *enlarged follicles*, which project one-sixteenth or one-eighth of an inch. They vary in size, and contain *sebaceous matter*.

On the white skin *just outside*, but immediately surrounding the colored disk, the *secondary areola* subsequently appears. It consists of round, unelevated spots, of a *lighter color* than the surface on which they rest; hence they are said to resemble spots “produced by drops of water falling upon a tinted surface and discharging the color.” There is one complete row of them placed close together round the dark areola, and

other scattering ones a little further off that are less distinct.

Secretion of Milk.—In a woman who has never been pregnant before, this is considered a very valuable corroborative sign. Milk, in exceptional instances, runs from the breast weeks before delivery, and a drop of lactescent fluid may be squeezed from the nipple as early as the twelfth week of gestation in some cases.

The dates at which these several breast signs appear are as follows: The *secondary areola* does not become visible till the twentieth or twenty-fourth week; the *silvery lines* do not appear till near the end of pregnancy; and nearly all the other signs on these parts commence from the eighth to the twelfth week, and then become more pronounced as pregnancy goes on.

What Degree of Certainty Can be Attached to the Breast Signs?—They are totally unreliable, taken alone. In conjunction with other early signs they may lead us to suspect the existence of pregnancy, but such a suspicion should not be crystallized into an expressed opinion until more positive signs appear. Their absence does not negative pregnancy.

Conditions resembling them may occur from uterine or ovarian diseases independent of gestation. Many of them continue a long time after delivery, and might thus be erroneously attributed to a supposed succeeding pregnancy. Confusion of this sort arises when pregnancy is suspected during lactation, or after a concealed or unknown abortion. The secretion of milk has been produced artificially, not only in females, but even in males.

In *primiparous women* the occurrence of the *secondary areola*, the secretion of milk, and the fact of our being able to force a drop of lactescent fluid from the nipple, deserve great consideration; but in *multiparæ* they must be taken *cum grano salis*. *Suppression* of the milk secretion in nursing women is of considerable value as a corroborative sign.

3. Morning Sickness.—This consists in nausea, which may or may not be accompanied by vomiting on first rising in the morning, or it may take place at or after the morning meal.

It usually begins about the fourth or fifth week and lasts until the end of the sixteenth, or later. Sometimes it comes on a few days after impregnation, and continues throughout pregnancy.

It is a sympathetic disturbance, most likely due to a degree of congestion of the uterus beyond the physiological limit, and for which it is, to some extent, a natural corrective. Sexual excitement after conception is probably a factor in its production.

It justifies the suspicion of pregnancy only when it occurs and persists without any other special cause and in a woman who is otherwise healthy and well.

In some pregnancies it does not occur at all.

4. Morbid Longings and Dyspepsia.—Some pregnant women have an unusual desire for sour apples and other acid fruits or drinks, and salads prepared with vinegar, etc., or there may be a liking for substances still more unpalatable, such as chalk, ashes, lime, charcoal, clay, and slate-pencil; even putrid meats and spiders have composed a part of the chosen *menu*. Occasionally there is entire loss of appetite, or a disgust for particular substances.

Heartburn, pyrosis, flatulence, and unpleasant eructations are of common occurrence.

These dyspeptic symptoms and morbid longings begin about the same time, and have about the same diagnostic value as morning sickness, and their duration is equally uncertain.

5. Changes in the Size and Shape of the Abdomen.—During the first eight weeks of pregnancy the abdomen is really flatter than before, and presents no increase in size. This is due to sinking down of the uterus, which pulls the bladder down a little, and the bladder, in turn, by means of the urachus, draws the umbilicus inward, so that the navel and its immediately surrounding abdominal surface appear drawn in instead of prominent. Hence the oft-quoted French proverb: "*En ventre plat, enfant il y a.*"

"In a belly that is flat,
There's a child—be sure of that."

But you cannot be *sure* of it.

By the twelfth week the fundus uteri begins to rise above the brim of the pelvis, where it can be felt with the hand over the pubes. The navel is still sunken.

At the sixteenth week the fundus has risen about two inches above the symphysis pubis. The navel is no longer unusually sunken.

So the vertical enlargement progresses at the rate of about one and a half to two inches every four weeks, until the fundus, at the thirty-eighth week, almost touches the ensiform cartilage. During the last eight weeks the umbilicus protrudes beyond the surface.

About two weeks before delivery the womb sinks down a little, the abdomen becomes less protuberant at its upper part, and appears smaller in size. This is generally ascribed to relaxation of the pelvic ligaments and soft parts.

FIG. 66.



Size of uterus at various periods of pregnancy.

We may more easily remember the position of the fundus at different stages of pregnancy by dividing the whole term into thirds, as follows :

At the end of the *first* third the fundus rises a little above the pubes—say it is *at* the pubes.

At the end of the *second* third it reaches the navel.

At the end of the third *third* it reaches the ensiform cartilage, allowing for sinking during the last week or two.

By subdividing the intermediate spaces into thirds, and allowing one-third of upward expansion of the funds for

each four weeks, we shall attain approximate precision sufficient for practical purposes, for there are great differences in different cases.

The principal characteristics by which enlargement of the abdomen from pregnancy may be distinguished from other kinds of abdominal swelling are as follows: The pregnant womb is usually *symmetrical in shape*; it is *longer vertically* than transversely; its *contour is smooth and even*; it possesses

FIG. 67.



Palpating the uterus. (PARVIN)

a peculiar, *stiff, elastic consistency*, and may be felt to *contract under palpation*. By careful, firm pressure it may also be felt to contain a *movable, floating solid body*—the fetus. It is not easy to distinguish these peculiarities by palpation of the abdomen. The sense of touch must first be educated by long practice, and even then, in doubtful cases, the *history, origin, duration, and accompanying symptoms* of the enlarge-

ment must be fully studied before we can attach to them much diagnostic importance.

Method of Examination.—To ascertain the size and other characteristics of the gravid womb by palpation, either the mode of manipulation already mentioned under "Quickening" (page 120) may be used, or one hand may be placed upon the abdomen, as shown in Fig. 67. In this illustration the left hand is used, the examiner standing to the right of his patient. The hand is curved to fit the contour of the uterus and placed, at first, low down over the hypogastric region. Intermittent pressure is now made, and during each intermission the hand is carried gradually higher up, the pressure being greater at the *ulnar border* of the hand, so that when the fundus of the womb is reached the hand at once recognizes the diminished resistance and sinks deeper into the abdominal space above the uterus. Detection of the enlarged uterus is easy late in pregnancy. During the earlier months, when the tumor is not well above the pelvic brim, it is more difficult. In these latter cases let the lower limbs of the woman be extended and slightly separated; then place both hands flat upon the abdomen and make continued firm pressure while the woman takes several deep inspirations. During the consequent expirations the resistance of the abdominal walls will finally yield, and the hands be enabled to explore the region of the pelvic brim and demonstrate the enlarged womb. Beware of mistaking a distended urinary bladder, or one whose walls are hypertrophied and in a state of contraction, for a contracting pregnant uterus. Fibroid and other tumors of the uterus; cystic and other tumors of the ovary; distention of the womb from retained menses; accumulations of fluids or gases; obesity; pseudocyesis; enlargement of liver, spleen, and other of the abdominal viscera, etc., may lead to enlargement of the abdomen simulating pregnancy. The history and duration of the swelling, together with accompanying symptoms, should prevent its being mistaken for gestation. (See Differential Diagnosis, page 140.)

6. Softening and Enlargement of Os and Cervix Uteri.—

In making a digital examination *per vaginam* the differences to be noted between a *virgin* uterus and an impregnated one are very characteristic; but between the impregnated and

unimpregnated uterus of a woman who has already borne children the differences are less marked.

Scarcely any change takes place during the first few weeks of pregnancy other than the alteration of position in the womb already noted, together with increased weight and consequent diminished mobility of the organ.

The chief characteristic of the virgin cervix uteri is *firmness* of consistency. Very soon after impregnation it begins to *soften* and *enlarge* circumferentially. The lips of the os externum become wider and puffy to the touch, and the fissure of the os becomes rounder and larger. The softening begins at the outside (vaginal surface) and lowest part of the cervix and gradually extends upward and inward until the compact nodule of the virgin cervix is converted into a soft, elastic projection whose length is *apparently* shortened by increase of width and diminished resistance to the examining finger.

These changes begin soon after conception, but scarcely become easy of recognition till about the fifth or sixth week. In sixteen weeks the *lips* of the os are softened; in twenty weeks *half the cervix* is soft, and the *whole* of it has undergone the same change when the "term" is within a month of completion.

After one child the cervix never goes back to its pristine virgin firmness, nor does it recover the perfect smoothness of surface and smallness of the external os characteristic of the virgin uterus.

Again, during a first pregnancy the os will not admit the end of a finger; during a subsequent one it generally will.

The *diagnostic value of softening and enlargement of the cervix uteri* is only relative; their *absence* would generally *negative advanced* pregnancy; but as they may occur from other causes, the affirmative evidence they furnish is not reliable.

7. Violet or Dusky Color of Vaginal Mucous Membrane.—

By Jacquemin (who first discovered this sign in examining the prostitutes of Paris) and others, it has been considered to furnish positive evidence of pregnancy, especially during the early months. This is an error. The discoloration is due to venous congestion, and conditions closely resembling it may occur from uterine or vaginal congestion independent of pregnancy; as it can only be observed by inspection, it is not always available.

8. **Irritability of the Bladder.**—Frequent micturition from irritable bladder is so common during the first three months of pregnancy that it is recognized as one of the signs of gestation. It is caused by pressure of the normally prolapsed uterus upon the bladder. When the uterus rises during the fourth month, the symptom usually disappears. It may be accompanied by slight involuntary discharges of urine when the patient coughs, laughs, sneezes, or vomits.

9. **Pigmentary Deposits in the Skin.**—Besides darkening of the areola of the nipples before mentioned, there is occasionally a brown, areolous blush around the umbilicus, which may extend along the median line to the pubes. It varies with the complexion of the patient. In rare instances the color covers the whole abdomen, and cases are recorded of its spreading over the entire body.

Irregular patches of pigment (*chloasmata*) also appear on the face, with dark rings under the eyes. They disappear after delivery, sometimes sooner.

10. **Mental and Emotional Phenomena.**—A marked change of temper in the woman, as from amiability to peevishness, from cheerfulness to melancholy, etc., or exactly opposite changes, may occur. In some women the *moral* sense is depraved or elevated; and *intellectual power* may be modified in degree.

These signs are only of corroborative use in diagnosis. They are generally more apparent to the household than to the physician.

Additional Signs.—The following additional signs may be noted: Toothache or facial neuralgia, or actual caries of the teeth, during successive pregnancies; salivation without mercury; a tendency to syncope in women not disposed to faint when unimpregnated. Some women date impregnation, and often correctly, from unusual gratification during a particular act of coition.

The introduction of a clinical thermometer into the cervix uteri is said to indicate an elevation of temperature (1° or 2°) when pregnancy exists.

None of these indications are reliable.

SIGNS DURING EACH MONTH.

The different signs recognizable during the different *lunar* months may assist the obstetrician in judging the duration of an existing pregnancy and probable date of delivery. They are as follows:

First Lunar Month.—Absent menses. Gastric and mammary signs may, rarely, begin thus early. Tip of cervix begins to soften by end of month. Slit of the os more circular. Uterus sinks. Umbilicus depressed.

Second Month.—Mammary and gastric signs *usually* begin. Uterus sinks; hypogastrium slightly flat; umbilicus depressed. Softening of cervix extending higher. Menses suppressed, as during remaining months. Hegar's sign perceptible.

Third Month.—Gastric symptoms continue, mammary signs increase. Womb still sunken; os low in vagina; navel still hollow; hypogastrium still flattened; progressive softening of os and cervix. At *end* of this month womb begins to rise above brim of pelvis, with consequent higher position of cervix and less flattening of abdomen and sinking of navel.

Fourth Month.—Gastric symptoms commonly subside. Breast signs further develop. Continued ascent of uterus, hence cervix higher in vagina, navel less hollow, abdomen less flat, or beginning to enlarge. Fundus uteri by end of this month is two inches above pubes. Progressive softening of cervix. Women *may* "feel motion" toward end of the month, when skilled examiner may also detect ballottement and intermittent contractions. Uterine souffle audible by stethoscope. Very acute hearers claim to hear heart-sounds—very *unusual*.

Fifth Month.—Breast signs increase. The "secondary areola" appears. Quickening commonly occurs. Gastric symptoms entirely relieved. Ballottement easily recognized. Heart-sounds audible. Uterine murmur. Cervix softer, and *apparent* shortening begins. Fundus midway between pubes and navel. Abdomen visibly enlarged. Umbilical depression diminished.

Sixth Month.—Ballottement, heart-sounds, fetal motion, and uterine souffle more distinct. Lower half of vaginal

cervix softened. External os may just admit *tip* of finger by end of this month; this doubtful in primipara, though just possible. Breast signs and "secondary areola" increased. Umbilical depression almost effaced. Uterine tumor distinct. Fundus up to or just above navel. *Apparent* shortening of cervix increased.

Seventh Month.—Ballottement continues; auscultatory signs still more audible. Fundus two inches above umbilicus. Depression of navel well-nigh or quite effaced. Vaginal cervix *apparently* reduced one-half in length; lower two-thirds of it softened. Cervix still higher in vagina. Breast signs increased. External os may admit finger-*tip* even in primiparae.

Eighth Month.—Ballottement doubtful; other physical signs more audible. Greater part of cervix soft, and "*apparent*" shortening increased. Abdomen distended, and distinctly pyriform in shape. Umbilical depression gone. Fundus midway between navel and ensiform cartilage. Os higher and difficult to reach. Breast signs increased; milk *may* be secreted in some quantity in multiparae. Umbilicus may begin to protrude toward last week.

Ninth Month.—Ballottement absent; other physical signs more distinct. Umbilicus protrudes beyond surface of abdomen. Fundus still higher than last month. External os will easily admit finger-tip; and, in multiparae, os and cervix will admit finger to feel fetal head and membranes. Lips of os thick and soft, and apparent shortening of cervix rapidly progresses.

Tenth Month.—Height of os and fundus and prominence of umbilicus reach their maximum about middle of month, and then begin to lessen. Cervix uteri obliterated by *real* shortening during thirty-ninth and fortieth week. Lips of os, in primiparae, become thinner; in multiparae, retain more thickness till the end. Presenting part low down. Os uteri easily reached. Physical signs distinct. Symptoms due to pressure disappear. There may be oedema of legs and genitals, with pain and difficulty in walking.

DIFFERENTIAL DIAGNOSIS OF PREGNANCY.

From Ovarian Tumors.—In ovarian tumors (cystic degeneration of the ovary) the positive signs of pregnancy are

absent ; menstruation *generally* continues ; there is fluctuation ; history of tumor shows it to be of longer duration than pregnancy, and to have begun on *one side* of the abdomen ; cervix uteri not softened ; womb not enlarged, and can be moved without moving tumor ; or, when tumor is rolled to one side by abdominal palpation, cervix uteri does not participate in the movement, as demonstrated *per vaginam*. When the tumor is large there is emaciation, especially of the face, and failure of the general health. Exceptions to be borne in mind, *e. g.* :

Pregnancy and ovarian tumor may coexist, when abdominal palpation will reveal *two* tumors of different consistency, with a possible sulcus between them. Diagnosis difficult, especially when associated with dropsy of amnion (excess of liquor amnii). In the latter fluctuation is more superficial ; cervix uteri enlarged and softened ; womb *does* move with movement of tumor. After having decided to operate for ovarian tumor, should any lingering doubt remain as to pregnancy, the womb may be measured by the uterine sound, or the os dilated to admit examination by the finger.

The practice of aspirating some of the fluid in these cases for examination has been given up. There is no morphological or chemical element in ovarian tumors by which a diagnosis could be made.

From Fibroid Tumors of Uterus—Fibrous Tumors, Fibromyomata.—In uterine fibroids, tumor is (*comparatively*) harder and more inelastic ; it is unsymmetrical and nodular in outline ; of much slower growth than pregnant womb ; is accompanied with profuse menstruation ; cervix not softened, but may be unevenly enlarged. Positive signs of pregnancy absent, although the uterine souffle may sometimes be heard.

Rarely fibroids may coexist with pregnancy. Diagnosis : by physical signs of pregnancy and results of time. Labor will come on, and may terminate naturally, provided tumor does not obstruct pelvis.

From Distention of Uterus due to Retained Menses—Hæmatometra.—In retention of menses there is a history of pain at the menstrual periods ; uterine tumor grows by sudden enlargement at each period, with some decline in size afterward. Uterus more tense and resisting than in pregnancy. Vaginal

examination reveals mechanical obstruction, either in vagina or uterus, preventing egress of menses—this may be congenital, or acquired as result of inflammation, adhesion, etc. The breast signs and positive signs of pregnancy are absent.

From Distention of Uterus due to Gas—Physometra.—This is really a *tympanites* of the uterus. The gas, retained by some obstruction in the cervix, is due to decomposition of matters within the uterine cavity. Womb enlarges more *slowly*, and to a *less degree* than in pregnancy. When large enough to be percussed, it is *resonant*. When lifted with the finger, *per vaginam*, it is lighter in weight than its size would indicate. Fetid gas may escape from vagina. Positive signs of pregnancy absent.

From Distention of Uterus due to Watery Fluid—Hydrometra.—The fluid accumulates in the uterine cavity, owing to obstruction in the cervix. Womb seldom larger than an orange, and grows slowly. Most apt to occur after “change of life.” Fluctuation may be detected. Absence of positive signs. Hydrometra and physometra are extremely rare.

From Obesity.—In enlargement of abdomen from fat, other parts of the body are enlarged; belly is soft and doughy to touch, and without any central (uterine) tumor. The positive signs of pregnancy and most of the signs about the breasts, etc., are absent. The cervix uteri remains small and unsoftened. The uterus itself is not increased in size or weight and retains its usual mobility.

From Abdominal Dropsy—Ascites.—In dropsy there is distinct fluctuation and no uterine tumor. Resonance on percussion of abdomen changes its boundary line (horizontally) by changing position of woman, owing to floating of intestines; cervix uteri unchanged; physical signs of pregnancy absent. Ascites and pregnancy may coexist. When the ascites is evident and the pregnancy doubtful, removal of the ascitic fluid by tapping will render the enlarged uterus and other signs of pregnancy more easily recognizable.

From Amenorrhœa Associated with Congestive Enlargement of Cervix Uteri.—This is accompanied with symptoms of uterine inflammation; backache; pains in the hips, abdomen, etc.; weight in perineum; difficulty in walking; and, on examination, the cervix uteri is tender to the touch. Time will clear up doubt. If pregnancy exist, enlargement of the *body* of the womb will soon declare it.

From Pseudocyesis.—This means “false” or “spurious pregnancy.” Women who *want* to be pregnant, and single women having reason to *fear* pregnancy, are apt to imagine themselves *enceinte* when they are not.

It occurs most often near the “change of life,” when cessation of the menses, obesity, tympanites, and various sympathetic phenomena appear to lend color to the false impression. There are hysteria and involuntary projection and contraction of the abdominal walls, simulating the enlarged womb and foetal movements, so-called “phantom tumor.”

Diagnosis: anæsthesia by ether at once disperses the abdominal signs, and vaginal examination reveals an unchanged cervix uteri, and an empty, unenlarged uterus.

From Tympanites.—Tympanitic distention of the abdomen gives tympanitic resonance on percussion. Physical signs of pregnancy absent. Uterus not enlarged. Tympanites and pregnancy may coexist. Exclude the latter by making *continuous* firm pressure upon the abdomen during several successive respirations, *increasing* the pressure during the expiratory acts, until the examining hands—one placed upon the other—feel the spinal column, and thus demonstrate the absence of any intervening enlarged womb. The abdominal enlargement of pregnancy is chiefly in an antero-posterior direction during the early months not from side to side—while in tympanites it is in both and all directions. Normally the folds of intestine remain above and behind the uterus during pregnancy, hence there should be no resonance on percussion in front of the womb; such resonance, however, occurs when the tympanitic intestine is forced between the uterus and abdominal wall by its own distention with gas.

From Subinvolution.—In subinvolution there is a history of previous pregnancy (which, however, might not be acknowledged). Patient has not been entirely well since her last labor or abortion; has suffered from pain in sacral, iliac, and lumbar regions; feeling of weight in the pelvis; leucorrhœa; menstrual disorder, together with nervous, digestive, and hysterical symptoms. The uterus, enlarged by pregnancy, becomes rounder and wider, both transversely and in an antero-posterior direction, while in subinvolution the enlargement is chiefly vertical, the *length* of the organ being increased more than its *width*. In pregnancy the cervix is softer, and the

body of the uterus more elastic than in subinvolution; and the cervix, vagina, and vulva are more likely to present a violet or purplish color. In subinvolution the size of the uterus never exceeds that of an *early* pregnancy, hence in doubtful cases time would settle the diagnosis.

METHODS AND ORDER OF EXAMINATION.

In examining a woman for suspected pregnancy the order of sequence in the several steps of examination should be as follows:

1. Oral examination as to history, symptoms, and duration of the case.
2. Examination by (*a*) inspection, and (*b*) palpation of breasts and nipples.
3. Examination of abdomen by, successively, inspection, palpation, percussion, and auscultation.
4. Vaginal examination: (*a*) digital, (*b*) bimanual, (*c*) by *inspection if necessary*.
5. Digital examination, per rectum, if required.

CHAPTER VIII.

HYGIENE AND PATHOLOGY OF PREGNANCY.

To anticipate the *pathological* phenomena of pregnancy without surprise we have only to recall the *physiological* changes that must necessarily take place with every gestation. Processes of *change*—of structural evolution—whether progressive or retrogressive, and whether occurring in man, woman, or child, are *always* liable to be interrupted by slight disturbing causes, and thus develop *pathological* phenomena of more or less gravity. The physiological changes incident to pregnancy are without a parallel, in their degree, in their number, and in the rapidity with which they occur. In a few months the uterus increases in *size* (from 3 to 12 inches in length; from $1\frac{1}{2}$ to 9 in width); in *weight*, from about an ounce to about two pounds, *not* including its contents. The capacity of its cavity is enlarged 519 times (Lusk, after Krause). The area of its external surface is increased from 16 square inches to 339 square inches. *All* of its tissues: its muscles, ligaments, arteries, veins, lymphatics, nerves, and nerve-ganglia, become tremendously hypertrophied. The uterus itself changes its *position*, prolapsing during the first two months, and gradually rising after the third. Later on (owing to distention of the rectum and sigmoid flexure of the colon), it becomes twisted on its longitudinal axis so that its anterior aspect looks somewhat toward the right, which brings the structures in the left broad ligament more to the front, and tilts the fundus a little toward the right side. Correlative changes in the abdominal walls, and in the position of the abdominal viscera, must also occur to accommodate the enlarged womb. The vagina and vulva undergo a somewhat similar hypertrophy, though less pronounced. Changes also take place in the folds of peritoneum and connective tissue in the pelvic cavity, as well as in the ligaments, cartilages, and joints of the pelvis itself. At the same time the mammary

glands are going through a hypertrophic evolution preparatory to lactation.

With these local phenomena must necessarily take place an extensive modification in the general system of the woman, especially with reference to the general nutrition. She provides the nutritive pabulum by which the growing organs are sustained, and by which the fetus, with its appendages and bag of waters, is built up. She must therefore form more blood, digest more food, and increase the activity of her excretory and secretory organs. The extra blood must be properly circulated, not only through the hypertrophied vessels of the enlarged reproductive organs, but also through the placenta; hence, in pregnancy, there occurs, normally, hypertrophy of the left ventricle of the heart, which disappears after delivery. The elimination of carbon dioxide by respiration is increased. In short, the pregnant woman has to provide nutriment, to breathe, to circulate blood, to secrete and excrete, for *two* individuals—herself and her fetus.

The suspension of ovulation and menstruation during pregnancy constitutes further changes of function, which, while natural enough, must add something to the expenditure of vital force.

With these varied and numerous structural and functional changes, and with the necessary increase of work imposed on the general nutritive system of the pregnant woman, it is scarcely to be expected that gestation, especially in women whose lives and habits are artificial and unnatural in many respects, should be altogether *latent* and free from unpleasant symptoms, if indeed it be unaccompanied with serious disease. The wonder is rather the other way, viz.: that suffering is not greater and diseases more frequent and severe than we find them. It may be well said: to breed easily is a good test of bodily soundness.

The abnormal surroundings and habits of pregnant women, especially in highly civilized communities, are more accountable for suffering and discomfort than is the pregnancy itself. Faulty hygiene, either from careless neglect, or ignorance, is often the real cause of disaster and distress. To preserve health is easier and better than to cure disease. With this in view the following directions will be of service,

HYGIENE AND MANAGEMENT OF NORMAL PREGNANCY.

Let every pregnant women breathe *pure air*; hence the atmosphere of the country is better than that of a city; out-door life (climate and weather permitting) better than indoors. Rooms to be well ventilated by having one or more windows down, even ever so little, *from the top*; atmospheric impurities usually accumulate *toward the ceiling*. Crowded apartments, theatres, churches, etc., should be avoided. Many pregnant women become peculiarly sensitive to disagreeable odors (*hyperosmia* has been noticed as one of the signs of pregnancy), as if nature had provided them with a special instinct to detect and escape infected atmospheres. Throughout pregnancy the elimination of carbonic dioxide is increased about 25 per cent., and during the later months the encroachment of the enlarged uterus toward the diaphragm impedes respiration; hence *pure air* becomes a prime necessity. Unfortunately, respiration is further restricted by *dress* (notably *corsets*) and by *muscular indolence*. Corsets should be discarded altogether during the later months or worn loosely, or, if persisted in, their "ribs of steel" should be interrupted with spaces of elastic fabric—a method of construction commonly provided by staymakers for pregnant women. Avoid waist-bands and girdles round the abdomen; let the weight of skirts be supported by suspenders from the shoulders. Garters, whether above or below the knee, may produce œdema of the feet and varicose veins in the leg. Among other vices of costume are high-heeled shoes, which impede locomotion and produce stumbling, with its sometimes disastrous consequences. All clothing should be comfortably warm, the lower limbs especially being protected from cold. Exposure to cold and wet, especially when over-heated, may lead to renal congestion and nephritis.

Muscular Exercise.—The best exercise for a healthy pregnant woman, even up to the day of her lying-in, is *walking in the open air*. At no period of pregnancy need it be interdicted, if kept within the limit of moderate fatigue. It increases respiration, appetite, and digestion, and promotes sleep. Violent exercise and muscular strain of all kinds,

especially lifting, must be avoided. Riding on horseback, on bicycles, and in vehicles without springs over rough roads are injurious; *per contra*, exercise in smoothly running carriages upon level roads is advisable. Much depends upon the woman: one may withstand almost every sort of jolting and rough usage without any ill effect, while another—more nervous, delicate, and excitable—will suffer, even to the extreme of abortion or premature labor, from very slight mechanical disturbances. Use care in all. Railroad and street-car travel may or may not be injurious, as the mechanical jarring is great or small and the women more or less excitable. They should be avoided during the last few weeks of pregnancy in all cases. No pregnant woman who is subject to sea-sickness should risk ocean travel, and those who suffer in the same way from the swinging of railway carriages should not travel by rail. One great virtue of out-door exercise is to divert the woman's mind from dwelling upon her comparatively trifling ailments and magnifying them into horrors of infirmity, with a liability to drift into chronic invalidism and hysteria. Let her be persuaded to resist languid lolling upon her couch and seek refreshment and exhilaration in the sun and air, provided, of course, there be no real condition *requiring rest*.

Food.—There is no reason, as a rule, why a *healthy* pregnant woman should make any great change from her ordinary diet. With fresh air, exercise, mental diversion, and freedom from the mechanical pressure of costume, her appetite and digestion may be good during most of her gestation. Moderate morning sickness may interfere with her first daily meal early in pregnancy, and the growth of a large uterus encroach upon the stomach during the later months, but in spite of these drawbacks most women manage to assimilate enough food to gain flesh and improve their general nutrition rather than otherwise. The woman's tastes—her likes and dislikes—may usually be indulged with advantage, at least in so far as they refer to ordinary foods. Wines and alcoholic drinks, together with tea (which constipates) and coffee, should be taken with great moderation, if at all. Ripe fruits of all kinds, and dried fruits—notably *prunes*, of which many pregnant women become fond—are of service in correcting constipation. While milk and chocolate may be taken when

desired, the one drink—most important to every function of the body—which many women neglect or refuse to take in sufficient quantity, is common *water*. The habit of *disliking* water may be overcome by a plentiful use of *common salt*, which produces thirst. Late in pregnancy, when there is little space for a full stomach, the meals may be small, but of more frequent repetition.

The Skin.—The skin must be kept clean by *warm* baths (not hot, not cold), taken at least three times a week. Sea-bathing is objectionable, yet some women enjoy it without injury. When, late in gestation, the woman becomes too unwieldy to undertake a bath, the external genitals may be cleansed with tepid water twice daily, and the skin rubbed with a wet towel. During later weeks of pregnancy the nipples should be kept scrupulously clean, free from pressure, and softened by applications of borated vaseline or cocoa-butter.

Sleep.—Sleep is important. If practicable, a pregnant woman should retire early, occupy a bed by herself, and sleep eight hours or more. While *coitus* after impregnation is a physiological absurdity and ought to be avoided, it will usually occur in spite of any advice to the contrary. Indulgence at times corresponding to the menstrual period is liable to cause abortion in those predisposed to this event. If abstinence be refused, enjoin moderation, and brief instead of prolonged sexual excitement.

Under all circumstances encourage the patient to refrain from anxiety and fear of her approaching travail. Substitute industry and social cheer for indolence and solitary brooding, avoiding always emotional excitement.

DISEASES OF PREGNANCY.

The diseases incident to pregnancy are numerous and varied.

Let it be remembered that most of them are due either (1) to *sympathy*—other organs being disturbed in consequence of the tremendous changes going on in the reproductive system; or (2) to *pressure*—the mechanical pressure of the gravid uterus upon neighboring parts; or (3) to *toxæmic infection*—produced by deficient elimination of the excreting organs, or

by other causes. Sympathetic disturbances predominate during the earlier months, mechanical disturbances during the later ones. The opposite blood conditions of *anæmia* and *plethora* also play an important rôle in determining the character and treatment of these diseases.

Again, generally speaking, the *nervous system is more susceptible to impressions during pregnancy* than at other times.

Finally, some of the pathological conditions to be studied are simply exaggerations of the physiological phenomena ordinarily numbered with the usual *signs* of pregnancy.

Classification of Diseases.—No classification of the diseases of pregnancy yet devised is perfect: all are arbitrary. For convenience sake we may group the several affections to be considered (confining the list to those *actually due to pregnancy*) as follows:

1. Diseases of the Digestive Organs :
 - a.* Salivary glands.
 - b.* Teeth.
 - c.* Stomach.
 - d.* Intestines.
2. Diseases of the Urinary Organs :
 - a.* Kidneys.
 - b.* Bladder.
3. Diseases of the Reproductive Organs :
 - a.* Uterus.
 - b.* Vagina.
 - c.* Vulva.
 - d.* Mammæ.
4. Diseases of the Circulatory Organs :
 - a.* Heart.
 - b.* Veins.
 - c.* Blood changes.
5. Diseases of the Respiratory Organs.
6. Diseases of the Nervous System.
7. Diseases of the Skin.

DISEASES OF THE DIGESTIVE SYSTEM.

Salivation of Pregnancy.—*Symptoms.*—A constant dribbling of saliva, day and night, but no offensive breath, as in mercurial salivation. Occurs usually during the early months, but may continue during the whole of pregnancy. It varies greatly in duration as well as in degree. Buccal mucous membrane may be red and tumid; the submaxillary and parotid glands tender and enlarged. The water of the saliva is increased; its solids diminished. Ptyalin may be deficient,

and digestion consequently impaired. Occasionally *gingivitis* occurs, the gums being red, swollen, tender, sometimes bleeding on pressure and retracted from the teeth, which become loose, with difficult and painful mastication.

Prognosis is doubtful as to *cure* before delivery, but no serious consequences need be apprehended further than anxiety and annoyance.

Cause.—It is one of the *sympathetic* affections. The sympathy between the salivary glands and the generative system is well known from the phenomena of mumps, coition, etc.

Treatment.—By gentle saline laxatives, which divert the excessive secretion to the intestinal glands, and by astringent mouth-washes of tannin, alum, sulphate of zinc, or potassium chlorate. Counter-irritation by tincture of iodine or small blisters externally, over the parotids. Extract of belladonna (gr. $\frac{1}{4}$, three times a day), or equivalent doses of atropia, may lessen the discharge. Pilocarpine (gr. $\frac{1}{15}$) and fluid extract of viburnum have been recommended. The following gargle may be used two or three times a day :

R. Sodii boracis glycerini,	f 3ij ;
Aquæ rosæ, vel aquæ,	f 3vj.—M.

Bromide of potassium has cured some cases apparently. *Iron* and other tonics, with generous diet, are important. No treatment is reliable.

Dental Caries and Toothache.—That pregnancy actually causes the teeth to decay is a widespread belief among physicians as well as laymen ; hence the proverb, “for every child a tooth.” It has been ascribed to acidity of the oral secretion from dyspepsia, but quite as likely it is due to malnutrition of the teeth from certain constituents of their composition having been appropriated to nutrition of the embryo.

Treatment.—In recommending operative procedures upon carious teeth during pregnancy, the degree of “nervousness” or emotional susceptibility of the patient, and the severity of the required operation, should enable the physician to judge whether the mental shock or physical suffering to be incurred would be likely to bring on abortion. Conclusion accordingly.

In case no operative procedure is agreed to, a dose of morphia may be administered hypodermically for *immediate*

relief of the pain, to be followed by anodynes, and *quinine* in full doses thus :

R. Quiniæ sulph.,	gr. xxx ;
Morph. sulph.,	gr. ss ;
Extr. belladonnæ,	gr. iss ;
Acid. sulph. aromat.,	q. s. ft. pil. vj.—M.

Sig.—Take one every four hours.

Other remedies are : Fld. ext. gelsemium, gtt. iij–v, three times a day, until slight ptosis occurs. Croton chloral, gr. ij–v, every hour, until not more than fifteen grains are taken.

Externally, warm applications and anodyne liniments (of camphor, aconite, laudanum, chloroform, etc.) may afford relief. Neuralgia of the face (*tic douloureux*) requires the same remedies. Faceache, headache, intercostal neuralgia, and other forms of the same disease, when caused by *anæmia*, require *iron*, to which arsenic may be profitably added, as in the following formula from Lusk :

R. Pulvis ferri,	gr. ij ;
Arsenic,	gr. $\frac{1}{50}$.—M.

To be taken in pill, three times a day, and continued several weeks ; or,

Ferri et quiniæ citras,	gr. v ;
Aquæ,	3j.—M.,

three times daily at meal hours.

To arrest caries of the teeth during pregnancy, Hirst recommends syrup of the lacto-phosphate of lime, one dram three times a day.

Derangements of the Stomach ; Excessive Vomiting ; Pernicious Vomiting ; Hyperemesis Gravidarum.—*Symptoms.*—Exaggeration of ordinary “morning sickness.” Vomiting increased in severity, duration, and frequency. May come on at all times, day and night. Ejected matters contain, successively, food, clear mucus, and regurgitated bile. May be severe pain in the stomach from continued retching ; apt to continue weeks, or even months, in spite of treatment ; then follow *constitutional symptoms*, fever, or sub-normal temperature, emaciation, restlessness, exhaustion, and,

later, fetid breath; dry, brown tongue; feeble and frequent pulse; night-sweats and insomnia. Still later, in the worst cases, vomiting stops (from exhaustion of reflex power of the spinal cord), and nervous symptoms appear, viz., delirium, stupor, coma, and rarely, *very* rarely, death. Vomiting of blood, even severe hemorrhage from the stomach, may occur in cases of gastric ulcer or cancer.

Prognosis.—Cases apparently hopeless sometimes “turn a corner,” as it were, and end in recovery when it is least expected. The symptoms may stop from sudden mental emotion, or the occurrence of spontaneous abortion; or, again, a new medicine, or some special article of food or drink may succeed after many others have failed. The gravity of the prognosis increases in proportion to *constitutional* symptoms and failure of general nutrition. It is worse in those cases complicated with some gastric or intestinal disease previous to pregnancy. Pernicious cases occur about once in 1000 pregnancies.

Causes.—Most cases of moderate severity may be attributed to reflex nervous derangement, just as vomiting attends diseases of the uterus. Stretching of the uterine muscular fibres by the growing ovum; flexions and versions of the womb; inflammation of the uterus, either of its body or neck; old peritoneal adhesions binding down the uterus; or several of these conjointly, may constitute etiological factors. Previously existing gastric catarrh, ulcer or cancer, and old intestinal lesions may explain some of the grave cases.

That in many cases the disease is a pure neurosis is evident from its being suddenly cured by some decided mental impression made by a new medical attendant who perhaps informs her authoritatively that the vomiting will stop at a given time after a given remedy; or he may alarm the patient by the dangers of impending abortion and thus stop it.

In every case it must be ascertained that the bowels, liver, and kidneys are not impaired in their functions, otherwise toxæmic vomiting may occur from retention of toxins that ought to be eliminated by these organs.

Treatment.—The remedies are “legion.” When some fail others must be tried. What will cure one case may be futile in another.

Diet.—*Total abstinence* from food or drink may be tried for a whole day, or even two or more complete days—a mode of

treatment easy of application *early*, not so *later*, when the patient is exhausted.

Liquid diet, in small quantities frequently repeated, in preference to solids, the order of selection as follows:

Milk; milk with soda-water; koumiss; buttermilk.

Iced milk.

Meat soups; either

Beef,	} carefully freed from grease.
Chicken,	
Mutton,	

Well-cooked farinaceous liquids:

Barley-water.

Arrowroot.

Rice-water.

Corn-starch, etc.

Should these fail, and the patient avow a *desire* for some *apparently* unsuitable article, give it to her as an experiment, and put the slops aside.

Eating ordinary "pop-corn" will sometimes stop it; so will chewing spruce gum.

Ice-cream, cracked ice, ice-water, and water-ices may do good service.

Wake the patient at midnight, or in the early morning hours, and give her (while recumbent) toast and coffee, or an egg, then quickly put out the lights and leave her alone to sleep again. Food thus given may be retained when it would be rejected at other times.

Scraped beef, *lean* and *raw*, spread on *very* thin bread, is worthy of trial.

In cases where no food can be retained and the general nutrition begins to fail, the patient may be sustained, for weeks together, by rectal alimentation alone. Peptonized beef tea and other animal broths, peptonized milk, white of eggs stirred in water, etc., in quantities of four or five ounces, three times a day, may be injected. Tincture of opium, or potassic bromide, or brandy, may be added to the enemata as circumstances may require. Diarrhoea and rectal intolerance, by preventing retention of the injections, may exclude the use of this treatment.

The enema should be slowly introduced high up into the bowel through a long soft-rubber tube or catheter, the rectum

having been previously washed out by irrigation with warm water. To secure retention of the injection, the patient should remain absolutely still after its administration, and pressure with a napkin against the anus should be maintained for a few minutes until the desire to evacuate passes off.

To relieve distressing thirst, a pint of normal salt solution may be injected high up into the bowel twice daily, the rectum having been previously cleansed by irrigation.

Medicinal Remedies.—Of the various medicines used, it is impossible to say which will suit any one case. For convenience of recollection they may be arranged in groups, as follows:

1. *Purgatives.*—A brisk cathartic pill, or laxative enemata, until bowels are freely open (especially if there have been previous constipation), will “work wonders” in relieving emesis. Accumulated toxins in the intestine, which may have caused the vomiting, are thus removed.

2. *Reflex Sedatives and Anodynes.*

R. Potass. bromid., gr. x-xx, in some aromatic water three times a day.

R. Chloral hydrat., gr. v (a small dose), given in solution, every two hours.

R. Pulv. opii, gr. j, given in a single pill with as little fluid as possible. Not to be repeated.

Should the stomach reject all these,

R. Potass bromid. 3j; or

R. Chloral hydrat. gr. xx; or

R. Tinct. opii, fʒss,

may be administered in a nutritive vehicle *per anum*.

Morphia—preferably the bimeconate—given either hypodermically or endermically (sprinkled on a blistered surface).

Anodyne plasters and liniments, or ether spray, applied over the epigastrium; also counter-irritants, *e. g.*, mustard, cantharidal collodion, or blisters of Spanish fly.

3. *Alkalies.*—Especially suited to cases of acid stomach, heartburn, etc. Give aq. calcis, ʒss with ʒss of milk, and repeat every fifteen minutes; or Vichy water; or magnesia with milk; or the aromatic spirits of ammonia (dose, xx drops) in ʒj of some aromatic water; or bicarbonate of soda.

4. *Acids*.—Lemon-juice, orange-juice, or the acid. sulphuric. aromatic. (dose, x–xx drops) in $\mathfrak{z}\text{j}$ of water. Citric acid (*syrup. acidi citrici*, U. S. P., f $\mathfrak{z}\text{ss}$). Carbonic acid (gas), as in soda water, or the effervescing draught of the U. S. P., etc. One or two drops of the *dilute* hydrocyanic acid may be added to the latter.

5. *Aromatic Bitter Tonics*.—Tinct. cardamom. co., or tinct. gentian. co., or tinct. cinchon. co., or tinct. rhei dulc. (dose of each about $\mathfrak{z}\text{j}$), or the infusion of calumba with aromatic sulphuric acid.

6. *Intoxicating Drinks*.—Champagne *ad libitum*. French brandy, sherry, whisky, *kirschwasser*. Either may be tried in sufficient quantities to produce slight intoxication. To be resorted to only after a trial of less objectionable methods of treatment.

7. *Unclassified Remedies*.—Given empirically :

Bismuth subnitrate, dose, gr. x–xx, before each meal.

Salicine, gr. v–x, three times a day.

Potass. iodid., gr. v, three times a day.

Oxalate of cerium, gr. v to x, before meals.

Vinum ipecac., gtt. j, every hour.

Creosote, gtt. ij, in aq. calcis, $\mathfrak{z}\text{ss}$.

Phosphate of lime, gr. xv–xx, in water, three times a day.

Tinct. iodinii *comp.*, gtt. x–xv, diluted, three times a day.

Fowler's solution of arsenic, gtt. j, three times a day.

Tinct. aconit. rad., gtt. ij–iv, three times a day.

Tinct. nucis vom., gtt. x, three or four times daily.

Muriate of cocaine—three per cent. solution—dose, gtt.

x–xx.

Pyroxylic spirit, gtt. x, largely diluted, t. i. d.

In all severe cases the patient should be kept at rest in bed.

Still other remedies may be necessary, as the restoration of a displaced or flexed uterus and its support by a pessary ; in cases of inflamed cervix uteri (or even when no such inflammation exists) pour a ten per cent. solution of argentic nitrate through a glass speculum into the vagina until the vaginal portion of the cervix is completely submerged ; let it remain ten or fifteen minutes, then decant it : to be repeated two or three times, at intervals of a few days. Relief is sometimes obtained by applying anodynes to the cervix and vault of the vagina ; a fifteen per cent. solution of muriate of cocaine, or

the extract of belladonna, or Battley's sedative, may be thus applied with a probe and cotton wool, or camel-hair brush. Dilatation of the os and cervix uteri with the finger will sometimes afford immediate relief, but care must be taken not to produce abortion in this way unintentionally.

A bag of cracked ice applied to the cervical or dorsal vertebrae for half an hour, two or three times a day, will sometimes stop the vomiting. Pencilling the fauces with a ten per cent. solution of muriate of cocaine has been lately suggested.

The (at best unphysiological) practice of coition during pregnancy is probably one of the causes of this vomiting, and should be interdicted.

Should all means of relief fail and constitutional symptoms of a grave character arise, the last resort may be adopted, viz., the induction of abortion or premature labor; but the cases requiring it are *very rare*, and it is not to be employed without a consultation of two or more physicians.

The best means of inducing abortion in these cases is by dilating the cervix uteri; but as moderate dilatation with the finger, as just stated, will often stop the vomiting, this should *first* be done, when, if the vomiting cease, further dilatation to produce abortion will be unnecessary. This mode of arresting vomiting was discovered accidentally by Copeman. The method bears his name.

Derangement of the Intestine: Constipation. Constipation is very common. Less often diarrhœa occurs. *Constipation* is a sympathetic affection during the early months, and due to pressure of the enlarged womb during the later ones.

Treatment.—During the early months *mild* saline laxatives, taken largely diluted before breakfast. After their action instruct the patient to visit the closet *daily* at a regular hour, and use gentle *massage* of the abdomen while there. Oatmeal porridge, and brown bread, bran bread, or cornmeal bread. Cool water to be drunk every morning before breakfast, and again the last thing at night. Grocer's figs, dates, prunes, or tamarinds at night before drinking the water. Forbid tea.

During the later months, when masses of scybala are liable to accumulate, castor oil with tinct. opii may be given, and injections (daily if required, at a regular hour) of soap and water; or hot water and glycerin, equal parts; or rectal suppositories of pure glycerin.

Should stronger medicines be necessary, either early or late, mamma may be given, or extract of colocynth with extract of belladonna, or an occasional blue pill with soap and asafetida; or a teaspoonful of compound liquorice powder at night; or R. Ext. colocynth. co., gr. ij, pulv. rhei, gr. j, ext. belladonnæ, gr. ʒ, ext. hyoseyami, gr. ss, in pill, at bedtime; or R. Aloin, gr. ʒ, strychnia, gr. $\frac{1}{60}$, ipecac. gr. $\frac{1}{10}$, ext. belladonnæ, gr. ʒ, in pill, at night.

Impacted fecal masses sometimes require removal by mechanical means and solvent enemata.

For chronic constipation direct massage in the closet, thus: When seated, let the patient place her arms "akimbo," the thumbs directed backward and plunged into the space on each side of the lumbar spine below the ribs, while the hands are spread out below the ribs laterally, and so moved about in a circle round the body, the ends of the thumbs and fingers making intermittent pressure.

Diarrhœa.—If it have been preceded by constipation, and the evacuations contain but little fecal matter, and consist chiefly of mucus, give a gentle laxative of castor oil and laudanum, or a dose of solution of citrate of magnesia to cleanse the bowel.

After being sure that no accumulation in the bowel remains, and in cases where none originally existed, give vegetable astringents with opiates, *ex. gr.*, the tinctures of kino, catechu, or krameria (dose of either \mathfrak{zj}), with tinct. opii, gtt. x, in \mathfrak{zss} of mist. cretæ, three times a day. Or pills containing acetate of lead, opium, and ipecac may be prescribed, or syrup of rhubarb with bicarbonate of soda.

In addition enjoin muscular rest and the recumbent posture; mustard, followed by warm cataplasms to abdomen and milk diet with well-cooked rice-flour, arrowroot, or corn-starch, etc.

The occurrence of diarrhœa during pregnancy must not be neglected. Unless checked, it may lead to abortion or premature delivery. It should be treated with great care, especially if accompanied with tenesmus or other signs of enteritis.

DISEASES OF THE URINARY ORGANS.

Diseases of the Kidney: Albuminuria; Uræmia; Toxæmia; Eclampsia.—Recently much prominence has been given to the so-called "*Toxæmia of Pregnancy*," or "general toxæmia,"

recognized as an *auto-intoxication* originating not from without, but in the woman herself. Many different theories are given to explain this toxæmia of pregnant women, but the treatment deducible from all of them is nearly the same, viz., *eliminative* treatment, to aid in getting rid of the toxins through the excretory organs. It is for the most part inadequate functional activity of these organs upon which the retention of toxins and toxæmia have their origin.

In a large majority of cases (90 per cent. or more) the *kidneys* are the organs at fault. From deficient functional activity of the kidneys excrementitious matters that ought to have been eliminated in the urine are retained; then follows uræmia or some other kind of toxæmia, which, when it becomes sufficiently intense, produces convulsions (*eclampsia*), and in the worst cases coma and death. A common and early symptom of this trouble is *albuminuria*, but albumen in the urine is a symptom *only*; we cannot regard it as a disease in itself, but only a sign of renal disease. Hence has arisen the now universal practice of examining the urine for albumen in *all* pregnant women; and a microscopic examination for tubercasts, blood corpuscles, and renal epithelium as further evidence of kidney disease, should also be instituted.

The frequency with which albumen occurs in the urine of pregnant women has been variously estimated at from 2 to 20 per cent. Probably those who obtain the higher percentage use exacting tests by which *mere traces* of albumen are detected, while the lower percentage is obtained by ordinary and rougher tests, when the quantity of albumen is greater. Slight traces of albumen may occur from the presence in the urine of mucous discharges from the vagina, urethra, and bladder, without kidney disease. Bad cases of renal disease going on to *convulsions* only occur once in about 500 pregnancies.

Etiology and Pathology.—Nothing is more unsettled than the causes and pathology of the renal troubles of pregnancy. All known lesions of the kidney—every variety of nephritis—may occur in pregnant women *as in other persons*. In some women renal disease is present when gestation begins. While some cases are thus accounted for, there are others in which renal disease only begins during pregnancy and disappears after delivery. It is these last that are difficult to explain. That

the morbid conditions observed are in some way produced by pregnancy cannot be doubted, and that previously existing renal disease is made worse by gestation is equally true. Theoretical explanations that explain some cases fail to explain others. The etiological factors probably vary in kind and number in different cases. Some of these factors (the relative potency and frequency of which it is difficult to define) are as follows:

1. Obstruction to the ureters owing to their being "stretched, flexed, distorted, or compressed" by the gravid uterus.

2. Sudden hyperemia of the kidneys, produced by cold and consequent suppression of perspiration.

3. Increased functional activity of the kidneys, required during pregnancy to excrete waste products of the fœtus.

4. Increased blood pressure in vessels of kidney from general arterial tension throughout the body, owing to cardiac hypertrophy (physiological hypertrophy of left ventricle) incident to pregnancy.

5. Mechanical pressure of the gravid uterus upon blood-vessels—either veins, arteries, or both—so as to disturb the renal circulation.

6. General increase in intra-abdominal pressure owing to tension produced by expanding pregnant uterus, and producing venous stasis in the kidneys.

7. Reflex vasomotor spasm of the renal arteries (and consequent renal anemia) originating peripherally from the uterus.

8. The alleged hydremic condition of the blood incident to pregnancy.

9. Anomalous distribution of large bloodvessels in the abdominal cavity, such ectopic bloodvessels being more liable to mechanical pressure by gravid uterus than vessels normally distributed.

10. Absorption into the blood of toxins from the intestine, owing to deficient action of the liver failing to eliminate these toxic materials during pregnancy.

11. It is possible the kidneys may participate in the vascular congestion of the genito-urinary system incident to sexual excitement. All *coitus* after impregnation is *unnatural*. This would help to explain the greater liability to renal disease in primiparae. Social customs and the laws of physiology are at variance in the sexual life of civilized peoples. None of these

views has been conclusively proved; most probably a plurality of etiological factors acts conjointly.

The lesions of the kidney vary, depending largely upon the existence or non-existence of structural changes prior to gestation. The evidences of nephritis, acute or chronic, interstitial or parenchymatous, may or may not be present.

The condition known as "*the kidney of pregnancy*" consists of anemia of the organ with fatty degeneration of its epithelial cells; but *without* nephritis. It is of frequent occurrence, but of less import than nephritic cases; its symptoms are less pronounced, appear later, and disappear more promptly after delivery than in cases where there is inflammation. The treatment of both conditions is practically alike.

Symptoms and Diagnosis.—The urine of every pregnant woman should be examined at short intervals, especially late in pregnancy, both chemically and microscopically, for evidences of kidney disease. Albumin is detected by *boiling* the urine, which coagulates the albumin, as does also nitric acid; but heat will give a precipitate resembling that of albumin if phosphates be present; this, however, is immediately redissolved by nitric acid. The amount of albuminous precipitate may vary from a barely perceptible opalescence to apparent complete solidification. Albumin is not always continuously present; it may be absent one day and appear the next, or *vice versa*—hence the examination should be repeated.

The *quantity* of urine passed in twenty-four hours should be collected and measured, and the total amount of *urea* it contains be approximately ascertained. This can be conveniently done by using the ureometer of Doremus with the sodic hypobromite solution, which gives the grains of urea in each ounce of urine. The total quantity of urea excreted daily should not be less than 400 or 500 grains.

Examined microscopically the urine exhibits renal epithelium cells, tube-casts—either hyaline, epithelial, or fatty—and perhaps red blood-corpuscles, the presence, number, or absence of these elements varying with the kind and stage of kidney lesion. Casts may be present without albumin, and *vice versa*.

The urine may be deficient in quantity, and of darker color than it should be.

In most cases there is *œdema*, puffiness of the face and eyelids; also of the hands, so that finger rings become tight. (Edematous swelling of the feet is common, but of less significance; it occurs in many pregnant women without kidney trouble. In some cases general anasarca occurs, involving the cellular tissue of the whole body, and even the serous cavities. Such a *very* extensive dropsy seems in some cases to be beneficial.

With these urinary and dropsical symptoms *only*, many women, under proper treatment, may go on for weeks and even months, without any other and more serious symptoms.

But in *every case*, whether mild or severe, there is an always to be dreaded darker side to this clinical picture, from the liability to toxæmia or uræmic intoxication.

The new set of symptoms indicating this uræmic poisoning, the early recognition of which is of the greatest import, are as follows: *headache, nausea and vomiting, epigastric pain, vertigo, ringing in the ears, flashes of light or darkness, double vision, blindness, deafness, mental disturbance, defective memory, somnolence*, symptoms easily explained by the circulation of toxic blood through the nerve centres. These may be preceded by lassitude, and accompanied by constipation, or by diarrhœa (uræmic diarrhœa). *Headache* is perhaps the most significant and common warning symptom. In bad cases the urine is reduced in quantity (almost suppressed), very dark in color, its albumen greatly increased, so that it becomes solid on boiling.

Next comes the final catastrophe of *convulsions (eclampsia)*. The convulsive fit begins with twitching of the facial muscles, rolling and fixation of the eyeballs, puckering of the lips, fixation of the jaws, protrusion of the tongue, etc., soon followed by violent spasms of the muscles of the trunk and limbs, including those of respiration; hence lividity of the face and stertorous breathing, biting of the tongue, opisthotonus, etc.

The fit lasts fifteen or twenty seconds, ending in partial or complete *coma*, possibly death; or consciousness may return, to be followed by other convulsions.

Premature delivery may occur, or if the case reach full term without convulsions, they may be looked for during labor. In some cases they come on *after* delivery without having previously occurred.

After labor the patient may recover; or after partial recovery may die later from Bright's disease; or remain more or less disabled from paralysis or mental derangement.

Prognosis.—This will largely depend upon the degree to which the uræmic toxæmia has progressed. Many cases with albumen, casts, and œdema, under proper and timely treatment escape toxæmia entirely, and go to term without further trouble; in others, the albumen and casts increase in spite of treatment, hence toxic symptoms and eclampsia are likely to occur. The outlook is now most grave. The maternal mortality after eclampsia is about 20 per cent. The child often dies, either from premature birth or from the existing toxæmia. Death of the child *in utero* is sometimes beneficial to the mother; her toxæmic symptoms improve; supposedly, because the metabolic processes of fetal life cease to produce toxins injurious to the woman. In twins there are *two* children whose defective metabolism may produce toxins; hence a graver prognosis.

Generally speaking, renal symptoms appearing *early* in pregnancy are worse than when occurring latter; the woman has longer to go before the relief of delivery. The entire absence of œdema is unfavorable. When convulsions occur the danger increases with their number and frequency. One fit may be fatal; cases have, however, survived after fifty convulsions. The majority of cases occur in primiparæ, in whom the prognosis is less favorable, owing to their labors being usually slower and longer than in multiparæ.

Treatment.—The main *principle* of treatment is *elimination*. The excretory functions of the bowels, skin, liver, and lungs must be increased to take the place of inadequate elimination by the disabled kidneys. In this way toxæmia is prevented, or when present, may be relieved. Hence, first, *purgatives*. Give pulv. jalap. co., ʒss; or calomel and jalap, of each, ten grains; and keep up a free action of the bowels with a daily pill containing extract of aloes and extract of colocynth, of each three-quarters of a grain, taken in the morning. In bad cases with symptoms of impending uræmia, elaterium may be given, but with care to avoid exhaustion and production of premature labor by its drastic effects.

R. Triturat. elaterini,	gr. ss;
Extr. hyoscyam.,	gr. j;
Ol. caryophylli,	gtt. j.—M.
Sig.—For one dose.	

When a milder purge is desirable, give a daily dose of Epsom salt; or a saturated solution of the same in doses of a tablespoonful, two or three times daily—enough to secure two or more loose stools every day.

Next in importance to purgation is promotion of excretion by the *skin*. Keep the patient warm in bed; or, if able to be up, let her wear warm woolen clothing; avoid exposure to cold, and take a daily warm bath, followed by brisk friction with a towel.

In cases of toxæmia, with impending eclampsia, submerge the patient, all but the head, in bath-tub of hot water—102° F.—covered with a blanket. Let her so remain thirty minutes, the temperature of the water being gradually increased to 110° F. On removal from the bath, wrap the patient in a hot sheet, place her in bed between thick woolen blankets, and cover up all but the face. During the bath cold wet cloths may be applied to the head to relieve headache, etc.; water drunk freely to promote diaphoresis, and a glass of wine given if faintness occur. Guard against exposure while cooling off, rising from bed, and dressing. Bath may be repeated once or twice daily. It has one drawback, viz.: the liability to bring on uterine contraction and labor. Chloral and the bromides may prevent this.

When the water-bath is not available use the *hot-air bath*, thus: Place a spirit lamp on the floor near the bed; over it arrange a large tin funnel, the long bent beak of which, placed beneath the bedclothes, conducts the hot air to the space occupied by the patient. It may be continued half an hour, and repeated daily.

The use of jaborandi and pilocarpine as diaphoretics is *not* advisable, from their liability to depress the heart's action, produce pulmonary œdema, and bring on labor.

It should be remembered that *sweating* and *purging*, if continued, will deplete the system much in the same way that bleeding would, and thus produce feebleness and frequency of the pulse, which may require stimulants (brandy, strychnine,

etc.), to keep up the action of the heart. It is under these circumstances that the normal salt solution (see below) serves the double purpose of acting as a *diuretic* and as a cardiac *stimulant*.

Lessen congestion of the kidneys and promote their secretion by extensive dry cupping with tumbler glasses or large cups over the loins, followed by the application of a mustard plaster to the same part for fifteen or twenty minutes; then hot poultices constantly applied and changed every two hours as they get cool.

Diuretics.—The best diuretic is ordinary *water*—two or three quarts daily. Vichy, Poland, or Buffalo lithia water may, however, be given, or the citrate of lithia in five-grain doses with infusion of digitalis; or the lithia salt may be dissolved in water and taken with one or two drops of *fluid-extract* of digitalis—more reliable than the *tincture*. Bitartrate of potassium, \mathfrak{zj} or \mathfrak{zij} , to a pint of water, with lemon-juice and a little sugar, is a pleasant diuretic drink.

The *diet* should be chiefly, and in bad cases *exclusively*, *milk*—two quarts daily. Milk itself is a diuretic; it is easily assimilated, and leaves but little débris in the bowel. Cases occasionally occur—probably from personal idiosyncrasy—where milk does *not* digest easily, and where it *does* leave masses of undigested matter in the intestine. Here it should be diluted with water, half and half. In mild cases fruits, salads, and light vegetables, with fish, toast, and bread-and-butter may be allowed. Meats should be forbidden.

In anæmic cases give iron—"Basham's mixture"—the *liq. ferri. et ammonii acetat.*, \mathfrak{zss} , t. i. d.

In toxæmic cases one or two quarts of normal salt solution¹ may be injected under the mammae; or into the connective tissue of the nates or abdominal wall.

The only way in which excretion by the *lungs* can be made to aid the disabled kidneys is by securing free respiration in pure fresh air. Remove waistbands and corsets. Ventilate rooms.

Auxiliary excretion by the *liver* is accomplished indirectly by the mercurial and other purgatives already mentioned:

¹ Prepared by putting 100 grains (approximately one teaspoonful) of common salt in a quart of water and boiling for five minutes; more exactly, 3 grains of salt to one fluidounce of water, which makes a six-tenths of 1 per cent. solution.

they probably act by lessening congestion of the portal venous system. No medicine is *positively known* to increase the secretion of bile. Nevertheless the old pill of Niemeyer containing one grain each of mass. hydrarg., pulv. digitalis, and pulv. scillæ, given three times a day, has been proved by long experience to be useful in these cases of inadequate kidneys.

Observe that, however the means may differ, the principle of treatment is always the same, viz.: restore function of the kidneys, or aid them by increased elimination through other organs, chiefly the *bowels* and *skin*.

When albumen and tube casts increase in spite of treatment, and especially when headache and other symptoms of toxæmia begin, abortion or premature labor should be induced.

The treatment of eclampsia by morphia, chloroform, etc., and the obstetrical management during labor will be considered in Chapter XXXIII.

Diabetes (Mellituria ; Glycosuria).—Sugar may be found in the urine of pregnant women without any symptoms of ill health, and disappear after delivery, or after lactation. This so-called "physiological glycosuria" is of frequent occurrence. Again, women who are already the subjects of diabetes may become pregnant, and the pregnancy go on to term without any necessary apparent interference.

But diabetes complicating pregnancy may be serious, or even fatal to both mother and child. These cases are very rare, especially so in primiparae. The child sometimes dies before birth (during the latter months of pregnancy), or soon afterward. The maternal deaths thus far noted have occurred after delivery or premature labor.

Diagnosis.—Detect sugar by chemical tests (Trommer's, Fehling's, Moore's, etc.). The womb may be over-large from dropsy of the amnion, or from the child being enormous in size, owing to dropsical infiltration. Liability to abortion or premature delivery. Pruritus of the vulva is apt to occur.

Treatment.—The dietetic and medicinal means employed for diabetes without pregnancy. Should these fail, the question of inducing premature labor must be considered as a last resort.

Bladder.—Irritability of this organ is indicated by frequent desire to micturate. It occurs as a sympathetic affection during the *early* months, causing distress and sometimes

disturbing rest at night. May also be produced by prolapse of the uterus during the first three months, relief spontaneously occurring as the womb rises during the fourth month. The worst cases, accompanied sometimes by serious cystitis, are commonly due to retroversion of the uterus. In any case of irritable bladder it is important to know whether the trouble be purely nervous, or on the contrary, due to cystitis. The urine tells: in purely functional cases it is clear; in cystitis, clouded with mucus or pus, which may be detected with the microscope or observed in visible strings or masses when the urine, after settling, is poured from one vessel to another. The possibility of gonorrhœa should be remembered. In cystitis the bladder is sensitive to abdominal pressure.

Late in pregnancy irritable bladder occurs from pressure of enlarged womb, especially when the child's head is large from hydrocephalus. Cross-presentations sometimes drag the bladder out of place and produce functional irritability of the organ, to be relieved by abdominal palpation restoring the child to its normal position.

Treatment.—In nervous or functional cases, without cystitis, rectal suppositories of morphia and atropia at night to secure rest. The following is an efficient and convenient remedy:

R. Ext. buchu, fld.,

Tinct. opii camph.,

āā f ʒj.—M.

Sig.—Teaspoonful (or more) every two or three hours.

Give bland mucilaginous drinks (flaxseed tea, cold infusion of slippery elm bark, etc.), infusions of uva ursi, or triticum repens, combined (if the urine be over-acid), with liq. potassa or potass. bicarb. Balsam copaiba and tinct. belladonna internally may be tried.

In cystitis, beside the foregoing remedies, the cavity of the bladder should be daily washed out with some warm antiseptic solution, viz., creolin, 10 drops to a pint of water; or either thymol, salicylic acid, or potass. permanganate, in the proportion of 1 to 1000 of water, or boric acid, 40 to 1000.

In all cases be sure the bladder completely empties itself. If necessary, use male elastic catheter. Restore the uterus if displaced. The knee-elbow position may enable the patient to empty the bladder. When the womb inclines forward, pressing upon the bladder, push back and support it with wide

abdominal bandage. Keep the bowels free from accumulation, thus leaving more room for the uterus and bladder.

Hematuria (Bloody Urine).—May occur from stone in the bladder, in which case the calculus should be removed by surgical operation during the *last month* of pregnancy, thus lessening the danger to the child from premature labor, should that occur from the operation. Hematuria also results from acute cystitis and nephritis and from pressure of the gravid uterus producing congestion and distention of the blood-vessels of the bladder—so-called “*vesical hemorrhoids*.” In this last case hemorrhage may be sufficiently severe to require astringent injections into the bladder; and uterine pressure should be relieved by the knee-chest posture, or Sims position. Laxatives if required.

Incontinence of Urine.—Small and frequent involuntary discharges of urine are often associated with over-distention of the bladder and loss of tone in its muscular wall. There may also be paresis of the vesical sphincter. The flow of urine occurs during coughing, laughing, sneezing, etc., but also at other times. It may be produced by uterine displacements; both anteversion, retroversion, and prolapsus.

Treatment.—In cases of deficient muscular tone in the bladder give tinct. nucis vomice; or strychnia; or tinct. ferri chlorid. for some days or weeks. For a shorter time, five drops of tinct. cantharides in $\frac{3}{4}$ of flaxseed tea may be taken t. i. d. Frequent ablutions and simple ointments may be required to relieve or prevent excoriations of the skin. A distended bladder will of course require a catheter.

Retention of Urine.—Usually due to retroversion of the uterus. Use catheter and treatment for retroversion (which see).

AFFECTIONS OF THE REPRODUCTIVE ORGANS.

Prolapsus Uteri (Falling of the Womb) during Pregnancy.—It usually rights itself when the womb rises during the third or fourth month, but, failing in this, the condition may become serious from the growing uterus getting jammed between the bony walls of the pelvis and pressing upon the bladder and rectum, or leading to abortion. The pressure of the growing uterus may even produce sloughing and gangrene, either of the womb itself or of the organs in contact with it.

Treatment.—Rest in the recumbent posture, with the hips elevated on pillows, pushing up the uterus by gentle manipulation, and, if imperatively necessary to keep it there, pessaries. Continue treatment until uterus gets large enough to remain above the pelvic brim. Should impaction occur and obstruct discharge of rectum or bladder, the induction of abortion may become a necessary resort to save the woman's life; and if the tissues of the womb be infected the entire organ should be removed by vaginal hysterectomy.

Retroversion of Uterus.—The fundus of the organ falls over backward, while the cervix is tilted upward and forward, toward or over the pubes.

Symptoms.—Pain in the back, numbness or pricking or unsteadiness in the lower limbs, and difficult or very painful defecation and micturition. The diagnosis is made on finding the fundus uteri in its malposition by a digital examination *per vaginam*, while the os and neck are tilted high up toward the pubes.

Prognosis.—Usually favorable from gradual spontaneous replacement as the womb increases in size, but serious or fatal consequences may arise from impaction of the growing organ (as in prolapsus) if it be not replaced during the earlier months.

This so-called "incarceration" of the growing retroverted uterus, apt to occur when sacral promontory is unusually protuberant, and in deformed pelvis.

Ulceration and sloughing of the bladder may occur from prolonged retention of urine with consequent uræmia; and obstruction of the bowel may cause absorption of poisons from the intestine and consequent toxæmia; the bowel, vagina, and bladder may ulcerate or rupture from pressure, and peritonitis, septicæmia, and pyæmia follow.

Treatment must not be delayed. Empty the bladder by a male elastic catheter. If this be impossible, aspirate the bladder. In using the catheter it should be remembered that the urethra is sometimes *elongated* to the extent of four or five inches. Empty the rectum. Place the woman in the *knee-elbow position*, and restore the organ by gentle digital pressure either by vagina or rectum, or both conjointly.

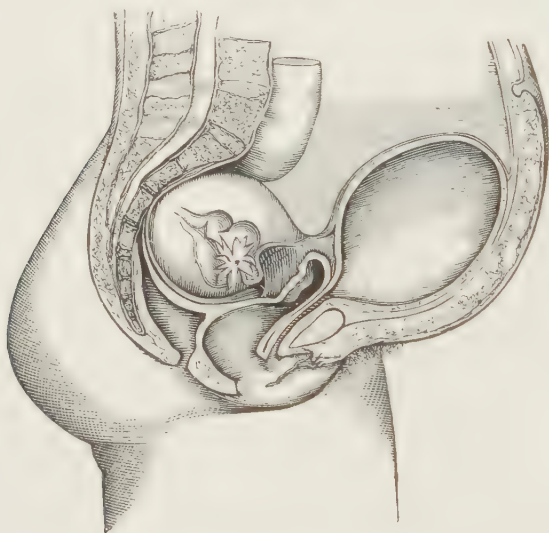
Should manipulation fail, make gentle, prolonged pressure by distending a soft-rubber bag in the vagina, or a Barnes' dilator in the rectum, the pressure thus induced being kept up

for several hours. After replacement a Hodge pessary may be required to retain the womb in its normal position, or tampons of aseptic wool placed behind the cervix in the posterior vaginal fornix may be used for that purpose.

Should *all* these means fail, the abdomen may be opened, and a hand passed in through the incision to lift the uterus out of the pelvis back into its proper place up in the abdominal cavity. The incision being closed, pregnancy may go on to full term.

In place of this method, abortion or premature labor may be induced.

FIG. 68.



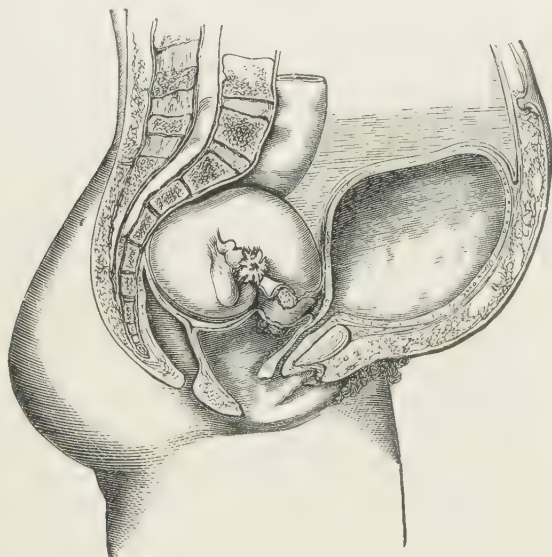
Retroversion at about twelfth week.

If the uterine tissues are infected, inflamed, ulcerated, or gangrenous, vaginal hysterectomy may be done.

Fig. 68, from Leishman (after Schultze), shows retroversion of gravid womb at about twelfth week, with retention of urine and enormous distention of bladder, owing to the urethra being dragged up and compressed by the displaced cervix uteri.

Retroversion of the uterus is frequently associated with some degree of *retro-flexion*--a bending of the axis of the womb, in which the os externum and vaginal portion of the cervix appear to maintain their normal position, while the fundus is *bent* backward toward the sacrum (Fig. 69); but the disastrous results are the same as in simple retroversion; so is the treatment.

FIG. 69.



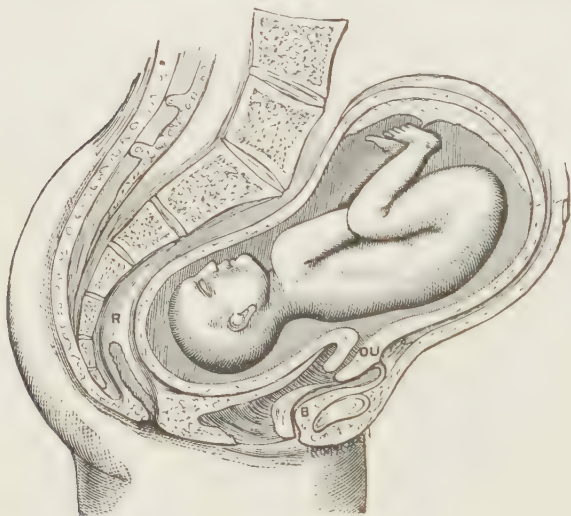
Retro-flexion of gravid uterus--sixteenth week. (SCHULTZE.)

In the case of retroflexion it occasionally happens that the womb becomes dilated into a sort of double sac, one pouch of it being above and the other below the pelvic brim, as shown in Fig. 70, from Barnes' work. Impaction and dangerous pressure upon bladder, etc., in the pelvic cavity, are thus relieved. *Both* pouches may also rise above the brim spontaneously as pregnancy proceeds, and the gestation reach full term; or, the lower pouch remaining in the pelvic cavity, full term may still be attained, but delivery is impossible, owing to displacement of the os above pubes, and occupation of

the pelvic cavity by the lower pouch, unless the latter be pushed up by manual pressure *per vaginam* and the os uteri brought down, which is the proper treatment during both pregnancy and labor. Should this method fail, the last resort is vaginal hysterotomy and extraction of the child through the incision.

Anteversion of Uterus.—Since the anterior pelvic wall is only one-third as deep as the posterior one, there is far less

FIG 70.



Bisacculated uterus—incomplete retroflexion. R. Rectum. OU. Os uteri.
B. Urethra and bladder.

difficulty in the fundus uteri getting above the brim when it is displaced anteriorly (anteversion) than when retroversion occurs. But when *above* the brim the womb may still remain anteverted and press upon the bladder, as occurs chiefly in deformed women (pelvic deformity), or in cases of ventral hernia, or in those whose abdominal walls have become relaxed and pendulous from frequent childbearing.

Diagnosis is made by vaginal examination revealing the os and cervix uteri far back, while the fundus, thrown forward, is felt through the anterior vaginal wall.

Anteflexion.—Anteflexion of the womb—*bending* of the uterus so that the fundus and body are curved forward toward the bladder and pubes—may or may not be associated with anteversion, just described. It is apt to occur in women whose uteri were anteflexed before pregnancy began. *Rarely* the fundus may become locked behind the pubes, but it is far more easily replaced than retroflexion, the pubic bones offering no projecting promontory like that of the sacrum. Recently, however, difficult cases occur from the anterior wall of the uterus having been *fixed* forward (before impregnation) by the operation of stitching the fundus to the abdominal wall for the relief of retroversion. When such "anterior fixation" of the uterus has been done, the enlargement of the gravid organ goes on chiefly by expansion of its posterior wall, while the anterior wall, tied down by adhesions, remains thick and unexpanded; hence irreducible anterior displacement.

The symptoms are irritable bladder, frequent micturition, increased by the erect posture and mitigated by recumbency. Vomiting excessive and troublesome. Pain in the hypogastric region and pelvic cavity. Diagnosis by the same means as *anteversion*, except that in anterior *flexion* the os and cervix may retain their *normal* position.

Treatment.—Replace the womb, in easy cases, by digital pressure upon the uterus through the anterior vaginal wall. Rest in bed, on the back. In cases of weak and pendulous abdominal wall, put on abdominal binder to support the womb from tilting forward over the pubes. In difficult cases with anterior adhesions, use persistent digital massage and vaginal tampons, to stretch or break up the resisting adhesions.

Leucorrhœa, or "Whites."—It consists of an excessive discharge of mucus from the vaginal canal. It is liable to irritate the vulva and produce itching and excoriation. Condylomata may exist, or granular papillary projections constituting granular vaginitis. Generally the disease is simply a hypersecretion, due to congestion of the vaginal wall or cervix uteri. It may be due to gonorrhœa or to endocervicitis.

Treatment.—Avoid the use of injections for fear of producing abortion. Frequent tepid emollient ablutions are indispensable for cleanliness, and to prevent excoriations, etc.

Laxatives to prevent constipation. If the discharge be sufficiently profuse to *require* moderating by astringent, use vaginal suppositories of tannin, alum, etc.

R. Acid. tannic., ℥j ;
 Ol. theobrom., q. s.—M.
 Fiat suppos. no. vi. Use one twice daily.

A muslin bag, large enough to contain twenty grains each of alum and bismuth subnitrate, may be introduced dry into the upper part of the vagina, and withdrawn by its attached string after twelve hours.

Instead of astringents, a single application of a 30 per cent. solution of carbolic acid in glycerine may be made to the vaginal mucous membrane and cervix uteri.

In gonorrhœal cases apply a 2 per cent. solution of argentic nitrate to *every part* of vaginal mucous membrane, with brush, through speculum, daily. Keep the parts clean with mild bichloride of mercury lotion.

Pruritus Vulvæ.—Intense itching of the vulva is of frequent occurrence during pregnancy. There is an irresistible desire to rub the parts, sometimes even during sleep, which may lead to excoriation, scabbing, ulceration, etc. Itching may extend over thighs, abdomen, and other parts of the body. In bad cases, suffering, worry, and insomnia may lead to mania and insanity.

Causes.—Irritating vaginal discharges, with lack of cleanliness. Glycosuria and parasites may produce it; also ingrowing hairs, and migration of seat worms (*ascarides*) from rectum. It is sometimes a neurosis, which, however, may depend on toxæmia.

Treatment.—In the *common* cases due to vaginal discharges, the principle of treatment is frequent cleansing of the vulva with soothing and antiseptic solutions or ointments. After washing with tepid sterile water, the best applications are a solution of *corrosive sublimate*, 1 to 1000, or if this irritate, use a 1 to 2000 solution, and follow it by warm salt solution; *carbolic acid*, ℥j to one pint of water or oil; or ℥j of the acid to ungt. rosæ, ℥iv. Paint vulva with *silver nitrate* solution, grs. xx to water, ℥j. Applications of lysol, resorcin, thymol, iodoform, or boracic acid, may be tried in succession.

For *anodyne* applications use a 4 per cent. solution of cocaine or an ointment of same strength, or the following :

R. Camphor,	}	āā ʒj ;
Chloral hydrate,		
Ungt. aqua rosæ,		ʒij ;

or infusion of tobacco (ʒss to water, Oj) ; or soda borat., ʒj to water, Oj ; or dust with a powder containing powdered starch four parts and camphor one part. Applications to the *vagina* may be tried ; a small tampon soaked in a 5 to 10 per cent. solution of lysol may be placed in the posterior vaginal fornix and remain for several hours ; or a silver nitrate solution (20 grains to ʒj) may be poured into the vagina through a glass cylindrical speculum and made to come in contact with every part of the mucous surface, when it is washed out by a sterile salt solution.

Many other remedies have been used in rebellious cases. Smoking a cigar has been known to stop it. Existing toxæmia must be relieved by eliminative treatment. (See *Uremia*, page 163.) Diabetic cases require dietetic treatment. Ingrowing hair must be removed. Rectal injections of infusion of quassia for ascarides, or a five-grain dose of *santonin* at night and a laxative of Rochelle salt in the morning.

If ulcers exist, remove scabs by warm poultices, then apply silver nitrate, grs. xx to water, ʒj, to be followed by ointment of calomel, ʒj to vaseline, ʒj.

Painful Mammary Glands.—Breasts are the seat of pain of a neuralgic character, due to rapid development. In plethoric women relief may be obtained by the derivative effect of saline laxatives. In anæmic, sensitive, nervous women, give iron, quinine, wine, and good food. In either case application of belladonna ointment, or the tincture sprinkled on a bread poultice, or anodyne liniments of olive oil, camphor, and laudanum, will afford relief.

DISEASES OF THE BLOOD AND CIRCULATORY ORGANS.

Palpitation of the Heart.—Palpitation of the heart may occur either sympathetically during the early months, or later

from encroachment of the enlarged uterus pushing up the diaphragm, and embarrassing the heart's action.

Treatment.—The sympathetic trouble is usually associated with nervous debility due to anæmia, and therefore requires iron, quinine, good diet, and a little wine. A plaster of belladonna over the cardiac region. Direct relief may be obtained, temporarily, by asafœtida, hyoscyamus, and other anti-spasmodics.

The opposite state of plethora *may* exist, when rest, laxatives, low diet, and, perhaps, bloodletting will be required.

For the mechanical embarrassments of the later months, little can be done further than palliation by antispasmodics and attention to the general health and excretory functions; but the patient may be consoled with the assurance of relief when the womb sinks down prior to delivery. Temporary ease may be attained by belladonna plasters over the præcordium.

Syncope, or Fainting.—The attacks may recur several times a day. The pulse is feeble, pupils dilated, consciousness partly lost, and there may be hysterical phenomena.

Treatment.—Recumbency with the head low, the application of ammonia to the nostrils, and diffusible stimulants, valerian, etc., during the attacks. In the intervals, iron, food, and bitter tonics. Bromide of potassium, gr. xx, three times a day. Remove corsets, tight-fitting clothes, and *all* belts, waist-strings, and belly-bands. Avoid crowded rooms and impure air.

Anæmia.—The *exact* blood-changes of pregnancy that occur *normally* are still unsettled, but the tendency generally is toward *anæmia*, which may become so pronounced as to require treatment. It is most apt to occur during the later months, when the red corpuscles and albumin of the blood are diminished and its fibrin increased.

When present before pregnancy begins, it gets worse, and may rarely progress to *pernicious* anæmia—sometimes associated with leukemia—and go on to complete exhaustion and death. Abortion or premature labor may occur and the fœtus die from inanition before birth. In pernicious cases, besides the usual *symptoms* of anæmia, there is a tendency to hemorrhage from the nose, stomach, and other organs, with pronounced emaciation, pallor, exhaustion, faintness, and vertigo. The *prognosis* is here most grave.

Treatment.—Laxatives (if constipation be present) followed by *iron*—preferably the solid preparations, viz.: Blaud's pills, iron by hydrogen, or carbonate of iron. Bitter tonics (elixir of calisaya, or tinct. gentian. co.) before meals and iron afterward. *Arsenic* is valuable, $\frac{1}{50}$ of a grain, with pulvis ferri., gr. ij in a pill after meals, t. i. d.

Give a meat diet—lean, underdone beef, or scraped, lean, *raw* beef; together with meat soups, milk, eggs, fish, bitter beer and wine. Sunshine, fresh air, exercise out of doors if practicable.

In cases with *hydræmia* and *œdema* of lower limbs extending to thighs, vulva, vagina, and uterus, the labia may be so swollen as to require small punctures to let out the fluid, under an aseptic technique, of course.

In any case progressing from bad to worse, despite treatment, abortion or premature labor may be advisable to save the woman's life. During labor septic infection is doubly disastrous, hence *rigid* asepsis is imperative; avoid corrosive sublimate as an antiseptic. After delivery some may recover under arsenic, iron, food, etc.; others not.

Plethora.—Plethora during pregnancy is rare; it may, however, occur, or simply constitute the continuance or increase of a pre-existing plethora. The *symptoms* are opposite to those of anæmia, except with regard to headache, giddiness, flushing of the face, and ringing in the ears, which may occur in both; but the general appearance of the female, together with, in plethora, the strength, fulness, and slowness of her pulse, will render diagnosis easy. Many plethoric women present a previous history of profuse menstruation. Uterine hemorrhage during gestation, and consequently abortion or premature labor, may occur, unless relief be afforded.

Treatment.—Saline laxatives to produce watery evacuations and thus lessen vascular tension; or a more decided cathartic to begin with. Avoid animal food, meats, eggs, milk, as also highly seasoned dishes, condiments, and stimulants. Restrict the *quantity* of food, and let it consist chiefly of vegetables, light soups, and cooling drinks. *Immediate* relief may be afforded by bleeding, even though the quantity of blood taken be quite moderate. Leeches or cupping will be preferable when, coupled with general plethora, there is local hyperemia of some particular organ, as the brain, kidneys, or uterus. Sexual excitement and coitus must be prohibited.

Varicose Veins, Hemorrhoids, Thrombus, etc.—Pressure of the uterus upon the large venous trunks causes distention and varicose dilatation of the venous branches below them. Hence oedema and varicose veins of the legs, hemorrhoids, dilatation and rupture of the veins of the vagina and vulva, with external bleeding, or formation of thrombi.

Treatment.—Rest in the recumbent position, support of the uterus by abdominal bandages, support of the veins of the legs by elastic stockings or well-applied roller bandages. Rupture of a varicose vein may occasion fatal bleeding; hence supply the patient with compress and bandage, and teach her how to use them in case of need.

Hemorrhoids require, in addition, laxatives to correct constipation, cool-water enemas before stools, and the avoidance of all straining efforts. Cold ablutions to the anus, followed by astringent ointment, *ex. gr.*:

R. Ung. gallæ,)
 Ung. stramonii, } āā ʒj.—M.

Sig.—Apply to anus, inserting some within the sphincter.

The ungt. gallæ cum opio (B. P.) may be used in the same way with excellent effect. Suppositories, each containing iodoform, grs. v, ext. belladonna, gr. ss, glycerine, ʒj, are both soothing and laxative. The confection of sulphur is a good laxative in these cases, and, contrary to former experience, aloes has been found beneficial, as in the following formula by Fordyce Barker:

R. Pulv. aloes soc., }
 Sapo. cast., }
 Ext. hyoseyami, ʒss;
 Pulv. ipecac., gr. v.—M.

Ft. pil. no. xx.

Sig.—Take one night and morning.

Thrombi of the vulva or vagina, if small, may be left to nature for absorption to take place. If large, causing pressure on surrounding parts and threatening rupture, the only treatment is free incision and careful removal of the contained clots, followed by antiseptic washing, cleanliness, rest, styptic applications if necessary to prevent the recurrence of future or stop existing hemorrhage. The prognosis in such cases is

doubtful. In all cases absolute rest should be enjoined to avoid the occurrence of embolism.

DISEASES OF THE RESPIRATORY ORGANS.

These comprise, chiefly, *functional disturbance of the respiratory acts*, manifested by two symptoms, viz., *cough* and *dyspnœa*. The acute and chronic *organic* diseases, pneumonia, pleurisy, etc., occurring *with*, but not *on account of* pregnancy, may be excluded from simple functional disturbances by the absence of their characteristic physical signs.

Cough and *dyspnœa* occur during the early months as nervous or sympathetic troubles, when they require anodyne and palliative remedies, counter-irritation by sinapisms, reflex sedatives (notably the bromides), and antispasmodics—valerian, camphor, morphia, dilute hydrocyanic acid, etc., as in the following combination :

R. Elix. ammon. valerianat.,	fʒij ;
Spts. ætheris nitrosi,	fʒij ;
Liq. morph. sulph.,	fʒss ;
Acid. hydrocyanic. <i>dilut.</i> ,	gtt. xij ;
Aquæ camph.,	ad fʒiij.—M.

Sig.—Tablespoonful every four hours, until relieved.

In cases of obstinate and persistent cough, ten drops of the oil of sandal-wood given with a dessertspoonful of the emulsio amygdalæ, three times a day, will sometimes afford relief.

During the later months cough and dyspnœa result from the enlarged uterus encroaching upward upon the diaphragm, thus interfering with a deep inspiration, hence the breathing is shallow, frequent, and unsatisfying. This is *most* observable where the womb is *very* large, from twins, dropsy of the amnion, etc. *Treatment* by palliatives, as in the sympathetic cases, but with little assurance of success until the womb sinks down before delivery, when we may anticipate spontaneous relief. Laxatives mitigate the suffering.

NERVOUS DISEASES.

Exaggerations of the mental and emotional phenomena already referred to as signs of pregnancy may occur. They lead us to apprehend insanity. The time of their most frequent occurrence is from the third to the seventh month.

Treatment consists in the promotion of *sleep* by bromides and chloral hydrate; laxatives; moderate exercise, cheerful society, and change of scene; together with attention to diet, and the proper digestion and assimilation of food.

Chorea.—Chorea during pregnancy is rare. It occurs chiefly in those who have previously suffered from the disease, and mostly in primiparæ. Its causes (admittedly obscure) embrace hereditary predisposition, the heart lesions of rheumatism and consequent embolic processes; anæmia, fear, sorrow, anxiety, and peripheral sexual irritation. It is apt to begin coincidentally with the early fetal movements. It is a serious complication, sometimes ending in insanity, premature labor, and, in about one-third of the cases, death. The child is sometimes affected with the disease.

Treatment.—The bromides and chloral to produce sleep and lessen the movements. Mental quietude; rest; avoidance of excitement; changes of scene and pleasant surroundings. Arsenic, iron, and bitter tonics. Sodium salicylate in rheumatic cases. As a last resort induction of premature labor or abortion. Prior to the latter proceeding moderate digital dilatation of the os uteri is worthy of trial.

Sciatica.—Pain in the pelvis, shooting down the thigh, sometimes accompanied with cramp, and tenderness on pressure over the sciatic nerve, are usually due to constipation and pressure of hard fecal accumulation. May also occur from uterine displacement—notably retroversion—and from the pressure of a large and heavy child.

Treatment.—Laxatives internally, and large rectal injections containing castor oil, turpentine, soap, and glycerine, until the bowel is completely empty. Subsequently, glycerine suppositories and the remedies previously recommended for constipation (see page 157). A displaced uterus must be replaced and retained in position (see page 169). The pressure of a large child can only be mitigated by the latero-prone posture, and loose clothing, together with anodynes.

Paralysis.—Paralysis (hemiplegia, paraplegia, facial palsy, or paralysis of the organs of the special senses) occasionally occurs.

Determine by urinary analysis whether or not the symptoms are due to the retention of urea or the presence of some other toxic agent in the blood. If so, the main element of

treatment will be by increased elimination—purgatives, diaphoretics, diuretics, etc. These failing, the question of inducing premature labor must be considered.

General Idiopathic Pruritus.—A distressing and sometimes exhausting nervous trouble is a general itching of the skin, without any visible lesion or eruption. In very nervous women it may lead to abortion. Is apt to be worse at times corresponding to menstrual periods. While difficult of cure, it ends with the termination of pregnancy. Palliative remedies are: inunction with vaseline after a prolonged soda bath. Application of carbolic acid (ʒj to water, Oj); or lin. saponis camph., ʒv, with chloroform, ʒj, applied on cloth. It has been cured by smoking a cigar. Solutions of chloral, menthol, or corrosive sublimate may be tried. Also linseed oil and lime-water.

Apart from this nervous itching without any skin lesion, actual *herpes* may occur (*herpes gestationis*), and return with succeeding pregnancies. Patches with redness, some with large bullæ, appear on the buttocks, abdomen, thorax, feet, and forearms, together with itching and burning. Affects young women more than others.

Treatment.—Use same palliatives as recommended above for nervous pruritus. When eruption begins anoint with borated vaseline or glycerol of starch; and when eruption is fully developed dust the surface with powder of bismuth and starch, or starch and talcum. Baths containing starch and bran are beneficial. Tonics, laxatives, and diuretics may be advisable.

Another skin trouble (*pityriasis gravidarum*, resembling *pityriasis versicolor*) occurring in feeble women, and diagnosed from pigmentary deposits by finding the characteristic parasitic fungi in the scales microscopically, can be relieved by washing thoroughly with tincture of green soap and applying veratrin, grs. x, in alcohol, ʒj.

Chloasmata: brown patches of pigment upon the cheeks and forehead, with darkened rings under the eyes. Are not amenable to treatment, but disappear spontaneously after labor.

CHAPTER IX.

INTERCURRENT DISEASES OF PREGNANCY.

A PREGNANT woman may be attacked with pneumonia, measles, smallpox, etc. Such diseases, while in no way *due* to pregnancy, occur as accidental *coincidences* seriously complicating it. The prognosis and results of such cases, with regard to the pregnancy itself, and to the life or death of the mother and fetus, and the rules for treatment, will here be briefly considered, without attempting any complete description of the diseases themselves. The acute fevers—malarial, continued, and eruptive—constitute an important group of these diseases first claiming our attention. They are all attended with *high temperature*. Continued high temperature seriously imperils the life of the fetus, and, in consequence, the continuance of pregnancy. Fœtal life is further endangered by changes in the composition of the mother's blood and in the maternal blood-pressure—the placental circulation being thereby impaired. The child may also be infected with the mother's disease.

Intermittent Fever—Ague.—Pregnancy is not, as was once supposed, a protection against ague. Not only may the mother have it, but also the child *in utero*, the latter being born with enlarged spleen and other evidences of the disease in consequence. In many cases premature labor occurs; in a small number, abortion. The fetus, if not dead, is often feeble and ill-nourished.

Treatment.—Quinine, or arsenic, as in cases without pregnancy. The fear of quinine *producing* abortion may be dismissed; the disease is much more to be feared than the medicine. Women in malarial districts who escape ague during pregnancy are liable to it after delivery. The attacks may be prevented by giving quinine during a few days following parturition.

Relapsing Fever ("Famine Fever").—Nearly all pregnant women attacked with this fever abort or have premature labor. Abortion is most common, and is attended with danger of great hemorrhage. Hemorrhage from the uterus may precede, and then contribute to produce, the abortion.

Treatment should be especially directed to the control of this hemorrhage before, during, and after delivery. The treatment of the fever itself should be essentially the same as in cases not complicated with pregnancy, care being taken to control elevation of temperature.

Typhoid and Typhus Fevers.—*Typhoid* fever during pregnancy is rare. When it does occur, abortion or premature labor is frequent. In *typhus* fever only about half the women abort. There is less danger of uterine hemorrhage in typhus than in typhoid. In both diseases the child is liable to be feeble, or dead, or it may die with symptoms of the mother's fever within a few days. The control of uterine hemorrhage and of high temperature constitutes the *special* element of *treatment*, besides the remedies commonly addressed to these fevers when uncomplicated with gestation. The prognosis, as to the mother's life, is grave, but the majority recover.

Yellow Fever.—This is a most dangerous complication of pregnancy; not less than two-thirds of the women die. Pregnancy affords no immunity from the disease, and parturition increases the liability as well as the danger. Abortion and consequent hemorrhage, suppression of urine, and uræmia are the chief causes of mortality. In cases that recover, and without miscarriage, it is said immunity from the disease is conferred upon the offspring. During the prevalence of yellow fever, pregnant women should be protected from the bites of mosquitoes, either by gauze screens, etc., or by anointing exposed parts of the body with spirit of camphor, oil of pennyroyal, etc.

Scarlet Fever.—This is more liable to occur during the puerperal state than during pregnancy, when it is comparatively rare. Both conditions add greatly to the mortality of the disease. Great liability to abortion or premature delivery—liability varies in different epidemics, owing, probably, to the varying type of the prevailing disease. Lying-in women exposed to scarlatinal infection develop a modified form of

puerperal fever, attended with peritonitis, cellulitis, and great mortality, called "Puerperal Scarlatina." During pregnancy scarlatina is a grave complication, both from abortion and from the kidney trouble of the fever adding to the albuminuria and renal trouble of gestation, especially in primiparae. In some cases pregnancy continues, both mother and child recovering without injury. Children are sometimes born with desquamation of the cuticle and other evidences of having had the disease *in utero*.

Treatment.—The same as for scarlet fever in the non-gravid. As a rule, pregnancy should not be artificially terminated except perhaps in bad cases of albuminuria and uraemia. Some obstetricians advise it to save a viable child, when the mother's life is in great jeopardy.

Measles (Rubeola).—Very rare during pregnancy. Liability to abortion. The child may be born bearing the eruption of measles, or develop the disease shortly after birth. Its death *in utero* is supposed to be the chief cause of the abortion. Danger of metrorrhagia (if abortion occur), which may be fatal to both child and parent. Rubeola during the puerperal state is frequently complicated with pneumonia—a complication of considerable danger.

Smallpox (Variola).—*Confluent* smallpox nearly always causes abortion or premature delivery, and is nearly always fatal to the mother, the danger increasing with the advance of pregnancy.

In *discrete* smallpox also abortion is very frequent, but less so than in the confluent variety, and the mother usually recovers. The child may be born with or without the disease, and, in some cases, with pits or scars indicating its having passed through it. Exceptionally, the child may have smallpox and the mother not have it. In twins, one child may have it and the other escape.

Abortion is liable to be attended with profuse hemorrhage. As a rule, the child, whether viable or not, is born dead. A very few survive.

Every pregnant woman exposed to variola should be vaccinated, unless protected by previous vaccination of recent date. A recently delivered woman, as a rule, should not be vaccinated; though it may be justifiable under circumstances of great exposure to a very virulent contagion. As a rule,

it will be advisable to vaccinate the child unless it exhibit evidences of variola. While in some cases the child appears to be protected by the mother having had smallpox during pregnancy, there is no certainty of this protection.

Varioloid during pregnancy involves only slight danger.

Cholera.—Liability to this disease the same during pregnancy as without it. Mortality greater as pregnancy is advanced. Abortion or premature labor is frequent, and may even occur after the woman survives the attack. Many die before the womb empties itself. Mild cases may recover without abortion. The child dies from asphyxia, or cholera infection, or from pathological changes in the uterine mucous membrane, chorion villi, and placenta. The clinical history is the same as in cases without pregnancy; so is the *treatment*. The induction of premature labor—formerly recommended—is not advisable. If labor occur, judicious means to hasten it are admissible.

Pneumonia.—Acute pneumonia during pregnancy is rare. When it does occur the danger to both mother and child is very great, and increases with the advance of pregnancy. During the last three months about half the women die; whereas, if the disease occur during the first six months, only one in five or six dies. Abortion or premature labor often occur, and more often in proportion as the pregnancy is advanced. This greatly adds to the danger. In some cases, even of extensive pneumonia, the pregnancy may continue, and both mother and child survive.

The death of the mother is usually ascribed to cardiac failure, sometimes associated with hydræmia and pulmonary œdema. The child dies from high temperature, deficient oxygenation of the blood, and imperfect blood-supply to the placenta.

Treatment.—Prevent the occurrence of abortion or premature labor, if possible. When labor comes on, it should be hastened by all prudent means, as in ordinary cases; in advanced pregnancy, by forceps, etc. The general treatment must be directed to strengthening the waning heart, viz.: brandy, ammonium carbonate, digitalis, and beef essence, with quinine to reduce the temperature.

Tubercular Phthisis.—The cases in which pregnancy *seems* to retard the progress of phthisis, or prevent its inva-

sion, are extremely few; those in which it precipitates the disease and hastens its progress to a fatal termination are many. The puerperal state and lactation still further favor the development and progress of phthisis in most cases. Abortion and premature labor are not common, unless the woman's condition be extreme and she is suffering from deficient aeration of the blood, when premature delivery may occur. The subjects of advanced phthisis are not apt to become pregnant; they usually have amenorrhœa, as well as leucorrhœa, and probably do not ovulate. In the earlier stages of phthisis conception is not interfered with. The children of phthisical mothers are usually small in size, but do not necessarily present any manifest evidence of defective development; they are predisposed to the disease, as well as to tubercular peritonitis, meningitis, etc. The placenta is liable to be affected with calcareous degeneration in tuberculous women.

Treatment.—When labor comes on, early assistance should be rendered by forceps, to forestall any increase of pre-existing prostration. The mother should not be allowed to nurse the child for the same reason, as well as for the additional one that her milk would not be proper for it. A wet-nurse or artificial food must be obtained for the infant. Women predisposed to phthisis should be advised not to marry, as well for their own sake as for that of their progeny, who may inherit the disease, and that of their husbands, who may contract it by infection.

Heart Disease.—The heart during pregnancy undergoes a physiological *evolution*, chiefly consisting of hypertrophy of the left ventricle, thus enabling the organ to perform the extra work which pregnancy requires. After labor, *involution* occurs, the organ returning to the condition in which it was before conception. When to these physiological changes of evolution and involution are added the valvular lesions of disease, it constitutes a serious and dangerous complication. Most of such cases are those of chronic valvular disease resulting from rheumatic endocarditis. Acute endocarditis may however, set in during pregnancy, or an old latent case may become acute from the violent strain imposed upon the valves during the exertion of labor. Acute pericarditis is extremely rare during pregnancy, and in the few observed cases pregnancy was not interfered with.

Valvular disease, both during pregnancy and labor, may not produce any serious or unpleasant symptoms, if compensative contractile power in the muscular walls of the heart be sufficient to carry on the circulation, despite the valvular obstruction and regurgitation.

But if this *compensation fail*, or become partially inadequate, a more serious condition at once arises. Local congestions, especially of the lungs, occur, with the following symptoms: dyspnœa (increased by exertion), precordial distress or actual pain, palpitation, frequency of pulse, and hemorrhage from the lungs, nose, stomach, etc. These symptoms, beginning moderately, increase, and may go on to distressing cyanosis with œdema, general anasarca, dropsy of the serous cavities, together with liver and kidney disease from congestion of these organs. The fetus may die from impaired nutrition, or from deficient oxygenation of the mother's blood, or from the mother's hemorrhages.

Mitral stenosis is the worst; mitral regurgitation is not so serious, especially if existing alone. Aortic lesions are more rare, and perhaps occupy an intermediate position, as to gravity, between mitral stenosis and the less dangerous mitral regurgitation cases. Combinations of mitral and aortic lesions are worst of all.

Treatment.—Whether a woman with cardiac disease should be advised not to marry will depend upon the lesion or lesions, and upon the degree of compensation. (See preceding paragraph.) With proper care, a good many can be carried successfully through pregnancy and labor. In bad cases, with already existing symptoms of inadequate compensation, pregnancy should be avoided.

Besides hygienic treatment—regulation of food, air, warmth, rest, baths, exercise, laxatives, and the like—the main point is to strengthen the heart-action by digitalis, strophanthus, and strychnia when symptoms of inadequate compensation arise. Epsom salt and calomel may be used as laxatives on occasion. If symptoms grow worse in spite of treatment, induce premature labor.

During labor, spare the woman from bearing-down muscular efforts as much as possible. Hasten delivery by forceps or version when the os uteri is sufficiently dilated. When not, and haste is imperative, incise the os or use Bossi's dilator.

Chloroform cautiously for anesthesia. A special danger occurs just *after* the child is expelled. Owing, as it would seem, to the sudden reduction of blood circulating through the uterus, more blood is thrown back upon the circulation and the heart, and all the symptoms are increased and heart-failure appears imminent. This is sometimes naturally forestalled by a moderate postpartum hemorrhage, which *if* only moderate should *not* be stopped by ergot, massage, etc., but actually encouraged. If no such salutary hemorrhage take place, and the embarrassment of the heart be threatening, recent experience proves that relief may be obtained, and perhaps life saved, by the removal of half a pint to a pint of blood by venesection (Hirst).

The cardiac tonics must be continued, both during and for some days or weeks after labor. Besides those already mentioned, nitroglycerine may be given, and for the relief of dyspnoea nitrite of amyl is especially effective.

Graves' Disease (Exophthalmic Goitre).—Graves' disease may originate during pregnancy and disappear afterward; but if previously existing it is made worse by gestation, with a tendency to uterine hemorrhage and liability to fetal death. *Goitre* without exophthalmos is also increased by pregnancy, and may produce sufficient dyspnoea to require relief by tracheotomy. There is no specially different treatment for these diseases than that employed in the non-gravid state.

Jaundice, Hepatic Toxæmia, Acute Yellow Atrophy of the Liver.—Jaundice occasionally occurs in pregnancy from extension of catarrhal inflammation from the duodenum into the bile ducts. It usually disappears spontaneously or after a calomel or saline purge. Every case, however, becomes of serious interest, inasmuch as it may be the beginning of acute yellow atrophy of the liver—an almost uniformly fatal disease, which, though rare, is specially liable to occur in pregnant women. But little is known of its pathology except that the liver undergoes a remarkably rapid atrophy. The successive symptoms are: jaundice, vomiting, anorexia, furred tongue, pain in and tenderness over the liver. Hemorrhage from the stomach ("black vomit") or from the bowels. Constipation or diarrhœa. These symptoms are soon followed by pronounced nervous symptoms due to toxæmia; viz., delirium, stupor, incontinence of urine and feces, convulsions, coma, and, usually within a week, death.

The urine is dark, contains blood and albumen, while its urea, uric acid, chlorides, sulphates, and phosphates are diminished. On standing, leucin and tyrosin form in it. There is *no treatment* other than attempted elimination by the skin, bowels, and kidneys of the pervading toxins. Rectal and subcutaneous injections of normal salt solution have been recommended. Miscarriage or premature labor may occur, but with no good result.

Liver Disease as a Cause of Eclampsia.—In the livers of those who die from eclampsia, there are nearly always found *areas of necrosis* in the liver-cells, and *thrombi* in the portal bloodvessels. Some of these vessels *rupture* either in the substance of the liver, or just beneath its capsule, producing *hematomata*. The necrotic areas, thrombotic processes, and blood extravasations may be microscopic in size, but sometimes visible to the naked eye. These findings suggest that the toxæmia producing eclampsia is due to impaired liver function—to a *hepato-toxæmia*—rather than to a *renal toxæmia*.

But there is no proof that these liver lesions *precede* the eclamptic paroxysm: hence they may be an *effect* of the convulsion rather than its *cause*. During the spasms, the whole venous system is engorged, sometimes to bursting, as in the brain. Lesions resembling those in the liver have been found in the pancreas.

The blood in the portal *vein* and its branches has no *heart* impulse to force it along: its circulation depends entirely upon the muscular movements of the abdominal walls and diaphragm in respiration. When these respiratory muscles are fixed by rigid spasm, partial or complete stasis of the portal blood seems inevitable. Toxic blood soon clots when at rest. Hence thrombi and necrosis of cell-areas, whose blood supply is thus cut off. Some of the distended vessels burst, hence *hematomata*. Thus the findings in the liver may be explained as an *effect* of the eclamptic seizures.

Defective liver function must, however, be recognized as a possible contributive factor in the production of toxæmia leading to eclampsia.

Treatment.—There is no special treatment for a hepato-toxæmia other than the eliminative treatment used in uræmia (*q. v.*).

CHAPTER X.

ABORTION AND PREMATURE LABOR.

ABORTION is delivery of the fetus *before it is viable*—i. e., before the end of the twenty-eighth week. Between this time and full term, discharge of the ovum is called "*premature labor*." No other division of the subject is necessary, though some writers limit the term "*abortion*" to discharge of the ovum during the first twelve weeks: if it occur between the twelfth and twenty-eighth week, they call it "*miscarriage*." The symptoms, however, differ somewhat during the first three months from those of the succeeding four, as does also the treatment. Exceptionally the child is viable before the twenty-eighth week, even a month or two earlier. Such cases are rare.

During the first three or four months the fetus and membranes are often discharged in the unbroken sac; after then, when the placenta is more fully formed, it is usually for the fetus to come first, the placenta and membranes afterward.

Frequency.—About one out of every five ¹ pregnancies ends in abortion, and ninety per cent. of childbearing women abort once or more during their lives.

Causes.—The *predisposing causes* may refer to either mother, father, or child.

A dead fetus is generally expelled without much delay. Its death may be due to disease of the placenta or membranes, or obstruction in the umbilical cord, or external injury, or deficient nutrition from a variety of circumstances, or inherited syphilis, or mineral and other poisons derived from the mother, or from the eruptive fevers. High temperature on the part of the

¹ In former editions of this work the frequency was stated to be one out of *twelve* pregnancies. It is probable the frequency is continually increasing with the artificial habits of civilization and the diffusion of knowledge as to methods of inducing abortion among the laity.

mother soon kills the child. When the mother's temperature reaches 106° it is always fatal to the fœtus, and a rise to 104° is dangerous, the danger being greater when the rise is sudden instead of gradual. The temperature of the fœtus is a degree higher than that of the mother.

On the part of the mother, constitutional syphilis is a potent cause. The occurrence of acute inflammation of the thoracic or abdominal viscera; the exanthematous fevers; plethora; anæmia; albuminuria; *excessive* vomiting; constipation; placenta prævia; diseases and displacements of the uterus, especially retroflexion and retroversion; multiple pregnancy; chronic lead-poisoning; chronic ergotism from eating bread made of spurred rye; the precocious or very late occurrence of pregnancy; the "abortion habit"—this last, if it have any real existence, usually means *chronic metritis, uterine displacement*, or some other disease which produces recurrence of the abortion.

On the part of the father, precocity, senility, syphilis, debauchery, and debility may lead to it.

Exciting Causes.—*Mechanical violence*, as blows, falls, violent exertion, the concussion of railroad accidents, excessive venery, sea-bathing, irritation of the mammae, tooth-pulling, etc.; or *emotional violence*, as excessive fear, joy, grief, anxiety, anger, etc.

Many abortions no doubt occur from the wilful administration of drastic emmenagogue medicines and from intentional disturbance of the ovum with instruments.

The above causes act, for the most part, in one of two ways, either by producing *death of the fœtus* or by inducing *uterine contraction*.

The most decided *exciting* causes are often strangely inert in the absence of any *predisposing* ones. In some women with an apparently "irritable uterus" very slight exciting causes will bring on uterine contraction; in others all sorts of injuries and surgical operations—even cœliotomy, removal of ovarian tumors, removal of fibroid tumors from the uterus itself, and amputation at the hip-joint may sometimes be done without any disturbance of the uterus or ovum.

Period of Occurrence.—It occurs most frequently during the second and third months, though, quite possibly, many abortions during the first month are never recognized.

Symptoms.—*Pain*, intermittent in character, and due to uterine contractions—in reality, miniature labor-pains; and *hemorrhage*, due to partial separation of the ovum from the uterine wall.

Chilliness, nervousness, anorexia, *emui*, flighty pains in the back and abdomen, frequent micturition, and a mucous or watery discharge, may occur and continue some days before “labor-pains” and bleeding, but they are not common until after the third month.

When the unbroken membranes with their contents are expelled entire (like a “soft-shelled egg”), which is most likely to happen during the first three months, the hemorrhage may be only moderate; but when the sac bursts and collapses after discharge of the fetus and liquor amnii, bleeding is usually more profuse. In these latter cases the bleeding and pains may cease for hours, days, or even weeks, but if the placenta or membrane be retained, these symptoms are *sure* to return sooner or later; and in case the retained secundines decompose there will be added a putrescent odor of the discharge, and, likely enough, a severe chill, fever, vomiting, general depression, and all the other symptoms of septic infection.

Diagnosis.—Pains and bleeding having occurred, the diagnosis is rendered positive by vaginal examination revealing partial or complete dilatation of the os uteri, and presentation in it of the bag of waters, umbilical cord, or body, of the fetus. Examine *all* discharges, preferably under water, for traces of membranes, fetus, and chorial villi, otherwise abortion may occur without recognition. Should doubt arise from discharges having been thrown away, unexamined, it may be stated as a *general rule* that if the womb have completely emptied itself, the symptoms will subside; if otherwise, they will continue, or recur after a possible remission.

Diagnosis of Abortion from Returning Menstruation.—In menstruation bleeding generally relieves the pain: not so in abortion; menstruation occurs at the period: abortion not necessarily so. In abortion there may be a history of violence or some other cause for the symptoms, and the early signs of pregnancy will have appeared. Should digital examination not afford sufficient evidence to clear up doubt, a *positive* diagnosis may be impossible until the os uteri have sufficiently

dilated to admit the finger-end, or until a part of the ovum has been expelled and recognized.

Diagnosis of Inevitable from Preventable Abortion.—Persistent and profuse hemorrhage, frequency and severity of the pains; considerable dilatation of the os uteri, which rapidly progresses, *as a rule*, indicate that the abortion cannot be prevented; but exceptions may occur. If the fœtus be dead, or the membranes broken, the abortion becomes still more inevitable; but it is not in all cases to be sure on these two points, and *very* exceptional cases occur in which a dead fœtus is retained for months and years. A pregnancy has even been known to continue after the membranes have been punctured, and after pieces of the decidua have been discharged, following the introduction of the uterine sound. Most cases follow the *general rule* first above stated.

Diagnosis of Incomplete Abortion.—In cases where the discharges have not been carefully examined, or have been thrown away without examination, and in which demonstration that the entire ovum has been expelled is in this way impossible, the only sure method of diagnosis is to pass a finger into the uterus and feel whether portions of the placenta and membranes still remain.

Diagnosis of Complete but Concealed Abortion.—This is very difficult. It depends chiefly upon the history of signs and symptoms indicating pregnancy and abortion; and upon the recognition of an enlarged uterus growing smaller by involution, the lochial discharge, and sometimes the appearance of milk in the breasts.

Diagnosis of Fœtal Death.—The signs of fetal death are languor, low spirits, pallor, chilliness, perhaps some fever, sunken eyes surrounded by darkened rims, nausea, anorexia, fetid breath, and bad taste in the mouth; a feeling of weight, discomfort, and coldness in the hypogastrium; flabbiness, with stationary or diminished size of abdomen, with loss of its normal firmness and elasticity; the uterus rolling more easily from side to side; flaccidity and diminished size of breasts, with the appearance of milk in them. These symptoms may not come on until *some time after* fœtal death. They may also be produced by other causes. The occurrence of several is necessary for diagnosis, which last, even then, may not be positive. Fetid discharges *per vaginam*, with or with-

out exfoliated epidermis, are more reliable. The detection of acetone in the mother's urine, as a sign of fetal death has proved to be unreliable.

When there is time for delay the best available sign of the fœtus being alive is continuous enlargement of the uterus, when the fœtus is dead the uterus ceases to grow, and may decrease in size. The condition is revealed by the bimanual examination, repeated at intervals of one or two weeks. In hydatidiform pregnancies, however, the womb may grow, even rapidly, when the fœtus has died. Finally, while the child lives, the temperature of the *uterus* (as tested by a thermometer in the cervix) will be one or two degrees higher than that of the *vagina*; if it be not so, the child is most probably dead. When pregnancy has sufficiently advanced, the absence or cessation of previously recognized heart-sounds and foetal movements is important. (For signs of foetal death during labor, at or near full term, see Chapter XXII.)

Prognosis.—Abortions often consume more time than full-term labors, owing to the long and narrow cervix uteri, and, as yet, imperfect development of the uterine muscles. The secundines are often retained hours or days after discharge of the fœtus. With proper treatment abortion is seldom fatal; it is less dangerous than full-term delivery, as regards the chances for life, but it is far more likely to leave chronic uterine disease and great debility from hemorrhage.

The chief dangers are hemorrhage and septicæmia from retained secundines.

Treatment.—The treatment of abortion will differ much according as we design to prevent, or, on the other hand, hasten delivery.

If the hemorrhage be only slight in degree, and the pains feeble, if the os uteri be not much dilated, and the membranes not broken, we strive to continue the pregnancy; if opposite conditions prevail, we cannot do so, but must hasten delivery to put the woman in safety.

Should the fœtus be dead, the uterus must, of course, be emptied.

Treatment to Prevent a Threatened Abortion when the Symptoms are Slight.—Absolute rest in the recumbent posture in a cool, dark room, with light bed-clothing. Mental and emotional quiet. Cooling drinks, avoidance of all stimulants. *Opium*

(preferably the liq. opii sedativus, gtt. *xx-xxx*) to arrest uterine contraction and check hemorrhage; or a suppository of morphia; the opiate to be repeated every two hours, or as often as may be necessary to stop the pains. Hydrate of chloral and the potassic bromide may be used instead of opium. J. Whitridge Williams recommends the following rectal suppositories to be repeated every four or six hours:

R. Codeiæ sulphat.,	gr. ss ;
Ext. hyoscyami,	gr. j ;
Ext. viburni prunifolii,	gr. v ;
Ol. theobromæ,	q. s.—M.

Playfair preferred chlorodyne in ten-minim doses every three or four hours.

Mild laxatives (salines, castor oil, or simple enemata of warm water) should be used to overcome constipation produced by the opiates. Never use ergot or the tampon; and the application of cold cloths to prevent hemorrhage is of doubtful utility; it rather augments uterine contraction. The *viburnum prunifolium* (fld. ext., *ʒj*, or solid ext., gr. *iv*, in pill every two or three hours) is alleged to be a valuable preventive of abortion; it quiets uterine contraction. Evidence in favor of its utility is increasing.

Remove any known cause of the symptoms and restore by posture and gentle manipulation any existing uterine displacement, especially retroversion or retroflexion.

Efforts to prevent abortion must, of course, cease after the *fœtus is dead*, but of this last event there is, during the first three months, no unequivocal sign. Reduction in the size of the uterus, or its smallness when compared with the known duration of the pregnancy, is perhaps of most diagnostic value in this respect. (See page 193.)

Treatment when the Abortion is Inevitable.—Let it be premised that in all manipulations and operative measures—whether digital or instrumental—resorted to in abortion cases, the same *rigid aseptic technique* must be observed as in full-term labors or surgical operations.

The external genitals, the vagina, the hands of the operator, and his rubber gloves and instruments must be made aseptically clean. (For particulars as to antiseptics, see Labor, Chapter XII., page 241.)

In most cases of abortion delivery may be left to complete itself by the natural powers. This is especially true of cases occurring during the first two months of pregnancy. Interference may be required in these, and later cases, on account of *excessive hemorrhage*. This may always be *surely* arrested by the vaginal tampon properly applied. The tampon also *stimulates uterine contraction* and promotes complete separation of the ovum from the uterus by causing effused blood to back up and accumulate between the womb and fetal membranes. The tampon is a vaginal plug, consisting, preferably, of iodoform gauze—strips two or three inches wide and as many yards long as may be necessary—which is to be packed *tightly*, first into the cervix uteri (with care not to rupture the amniotic sac), then into the vaginal fornices around the cervix, and so on down until the whole vagina is completely filled to the vulva; over this last an antiseptic pad, covered by a bandage, keeps the tampon from being expelled. To apply the tampon effectually, a Sims speculum is used to expose the cervix and vaginal roof, the instrument being gradually withdrawn as the tampon successively fills the upper and lower parts of the vaginal canal. A long curved dressing forceps is to be used in placing the tampon. Other kinds of antiseptic gauze may be used, and in cases of necessity almost any sterilized and antiseptic textural fabric may be substituted for the iodoform material. The tampon may remain twelve or even twenty-four hours. The most desirable result, which usually occurs within this time, is expulsion of the unbroken embryonic sac from the uterus into the vagina, whence it is easily extracted when the tampon is removed. The bladder should have been emptied when the tampon was applied, and care must be taken that the retention of urine is not produced by pressure of the gauze against the urethra, when a catheter may be necessary.

Should the patient have a sudden relief from pain while the tampon is in place, it may be *inferred* that the uterus has emptied itself, and then the gauze may be removed without delay. Fluid extract of ergot \mathfrak{ss} , every 4 hours, should be given while the tampon is in place, to contract the uterus and assist expulsion of its contents.

Whenever the os and cervix uteri are sufficiently dilated to admit one or two fingers, the whole contents of the uterus

should be at once scooped and scraped out by digital manipulation; or by a dull curette, the finger being usually preferable and certainly more safe. In using the finger, the patient must be anesthetized, the hand (greased with aseptic vaseline) passed into the vagina while the other hand makes counter pressure on the abdomen over the fundus uteri. The finger in the uterus will be able to dislodge the fœtus and placenta, and to ascertain positively that no fragments of the latter are left behind, which last cannot so surely be done with the curette. It is not necessary to remove the entire decidua vera; after the fœtal membranes and placenta are removed, remnants of the decidua may be left to come away of themselves.

Finally, the uterine cavity must be irrigated with a mild bichloride solution (1 to 4000); this to be followed by sterile water or normal salt solution—these solutions being of course warm (100° F.), or hot (110°–115° F.) if necessary to stop bleeding.

When the uterus is to be emptied by the *curette* instead of the finger, the patient must be anesthetized, placed crosswise on the bed, and her hips brought to the edge of it. The cervix is then seized with a volsellum forceps and drawn down to the vulva, being there held steadily by an assistant while the operator scrapes every portion of the uterine cavity with the curette until everything is removed. The hand of an assistant, or of the operator himself, may steady the uterus by pressure on the fundus. When the uterus is empty it should be irrigated with bichloride solution, and then with sterile salt solution, as before explained. It is usual to insert and leave a light strip of iodoform gauze in the uterine cavity and cervix (for drainage), which may be removed in twenty-four hours—the gauze is antiseptic, stimulates contraction, and stops bleeding. In many cases it is superfluous—some operators omit it entirely.

In “*incomplete*” cases, when the embryo has been expelled, leaving the membranes and placenta *in utero*, while it is true that in many instances the abortion *may* complete itself without interference, this may not occur for several days or even weeks, during which there is always danger of septic infection and recurrence of hemorrhage. The safer plan, therefore, is to empty the uterus at once by the finger or

curette, the os and cervix being dilated with a Goodell or some other dilator for this purpose when they have closed up after expulsion of the fetus. In neglected and delayed cases, when decomposition of the secundines has begun accompanied with putrescent odor, immediate emptying of the uterus is *imperative*, followed by antiseptic irrigation of the uterine cavity, to prevent sapriemia and septicæmia.

It hospitals or elsewhere, when experienced operators are available, the *surgical method* has been recently advised in *all* cases of inevitable abortion. It consists in emptying the uterus at once, with the finger or curette as previously described, after artificial dilatation of the cervix and anesthesia—just as one would do any other surgical operation for the removal of a morbid growth from the uterine cavity. This may be well enough under the circumstances mentioned, but in general practice the majority of cases have been, and will continue to be safely managed by the less radical methods of treatment previously described. To these latter I may add the method of *expression*. When the cervix is pretty well dilated, two fingers in the vagina and the other hand outside upon the body of the uterus, may thus express the unbroken ovum from the uterine cavity into the vagina. It requires some skill, and if unsuccessful, does no harm.

In abortion between the fourth and seventh months (so-called “miscarriage”) the fetal sac is seldom expelled entire; usually the fetus comes first, the secundines after a considerable interval. The pains are stronger, there is more liquor amnii, the contracting uterus can more easily be felt, and milk is more likely to appear in the breasts than in early cases. The principles of treatment are the same as previously described, but there may be difficulty in extracting the placenta which is generally adherent and the hemorrhage may be more profuse than in earlier cases, hence additional care in controlling it by tampons, ergot, and prompt removal of secundines.

The after-treatment of abortion must be continued rest, as after a full-term labor—ten days in bed, at least.

In women who have aborted once or more, and who are therefore likely to repeat the process, we should enjoin abstinence from *coitus* for a year or more; removal of all suspected causes of the accident; when pregnancy again occurs, insist on perfect rest *in bed* for a week or ten days at times correspond-

ing to the menstrual epoch. After conception, *coitus* must be forbidden during gestation.

The two common causes of repeated abortion, viz.: *chronic endometritis* and *retrodisplacement* of the uterus, should of course receive treatment.

Imperfect Abortion.—When remnants of the ovum remain *in utero*, as they may do for days, weeks, or even months, after a supposed complete emptying of the womb, it is termed “imperfect” or “incomplete” abortion.

All symptoms may subside, wholly or in part, but sooner or later hemorrhage will recur, with discharge of decidual or placental débris, which may or may not be putrescent—in the former case endangering septicæmia, etc. Such cases result from, and also lead to, endometritis. Retained blood may deposit successive layers of fibrin upon fragments of membrane or placenta, constituting so-called “fibrinous polypus,” Renewal of pains and bleeding ultimately result.

Treatment consists in completely emptying the uterus with the finger or curette, and the use of antiseptic injections.

Missed Abortion. As, at full term, the child may die and remain *in utero* weeks or months afterward, constituting so-called “missed labor,” so, during the earlier months of pregnancy, death of the fœtus may occur and the ovum still remain weeks or months in the uterine cavity; this is “*missed abortion.*”

In these cases the symptoms of pregnancy are arrested; milk may appear in the breasts; the liquor amnii is absorbed; the child macerates or becomes “mummified”—rolled up in the placenta or membranes like a parcel—but usually it is *not* putrid, for the unbroken membranes have protected it from atmospheric germs.

Pains, bleeding, and unexpected discharge of the mass usually result. When this last does not occur in *suspected* cases (*positive* diagnosis is difficult), catheterism of the uterus, or dilatation of its cervix by tents, to provoke contraction and expulsion of the ovum, is the proper treatment; or the cervix may be rapidly dilated with the steel dilators, and the contents of the uterus removed by the finger or curette, as in other cases.

Since a dead fœtus may be discharged months or years after the death or departure of a woman’s husband, this explanation may be necessary to shield the mother from unjust suspicions.

Before concluding this chapter on abortion it may be well to remind the reader that with regard to the *treatment* of those cases that do not terminate spontaneously, and which require interference either from excessive and continued hemorrhage, or on account of retention of the secundines, *two methods* of practice have grown up, viz. : *first*, the *expectant* method, comprising the use of the tampon, ergot, gentle expression, or digital extraction of the placenta when it presents in the os uteri, reserving the more radical method of scraping out the uterine cavity for cases in which decomposition of the secundines is beginning, or in which frequently recurring or long-continued hemorrhage has rendered more active measures necessary ; *second*, the *radical* or *active* method, by which *all* cases considered beyond prevention are treated actively *from the beginning*, the woman being anesthetized, the os and cervix uteri rapidly dilated with steel instruments, and the curette used to empty the uterus—scraping out fetus, placenta, and the entire decidua by one complete operation—just as a polypus or other morbid neoplasm would be removed by a somewhat similar surgical proceeding. Both methods of treatment have their respective advantages and disadvantages ; both have earnest advocates ; neither plan has been universally adopted. There will probably always be cases, or at least circumstances, in and under which each of the two methods may be judiciously employed. Much will depend upon the experience and skill of the physician. If he were always a skilful operator the radical method would doubtless be advisable in more cases than it is at present, when some are unable and unprepared to undertake a curetting operation.

Treatment of Premature Labor.—The management of labor after the seventh month is about the same as at full term. Dilatation of the os may be slow, but the child is smaller. The placenta is liable to be retained, but not so long as in abortion cases. Its delivery may be expedited by compression of the uterus through the abdomen, or, if this fail, and the occurrence of hemorrhage necessitate interference, two or more fingers, or the half hand or whole hand (according to the degree of dilatation of the os uteri, and the period to which pregnancy has advanced), may be introduced into the womb and the placenta peeled off with the fingers and extracted.

CHAPTER XI.

EXTRA-UTERINE PREGNANCY, ETC.

EXTRA-UTERINE Gestation (*Extra-uterine Fartation; Extra-uterine Pregnancy; Ectopic Gestation*) is development of the ovum outside the uterine cavity. Since some cases, while *misplaced*, are not entirely outside of the uterus, the term "*ectopic*" is perhaps best.

Varieties.—The ovum may lodge in the Fallopian tube (*tubal pregnancy*); when lodged in that portion of the tube which passes through the uterine wall, it is called "*interstitial pregnancy*." Rarely the tube is congenitally deformed; it enters the uterus externally as usual, but then descends in the muscular wall and opens into the uterine cavity lower down. An ovum lodged in such a tube would constitute a veritable "*interstitial pregnancy*." The ovum may remain in the ovary after the Graafian vesicle has ruptured (*ovarian pregnancy*); or it may find its way into the cavity of the abdominal peritoneum (*abdominal pregnancy*). There are several sub-varieties mentioned further on.

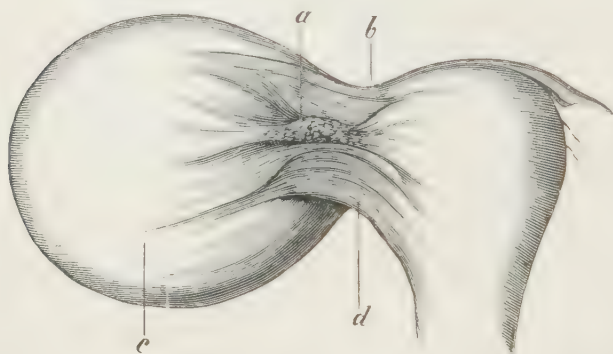
All forms of the trouble are rare: extra-uterine cases only occur once in 500 or 1000 pregnancies. The tubal variety is far more common than any other and will be first considered.

TUBAL PREGNANCY.

Causes.—Spasm, paralysis, stricture, sacculated dilatation, doubling of, or pressure upon the tube, causing obstruction of its canal. Loss of ciliated epithelium from inflammation, hence the ovum does not so easily reach the uterus. The tube may be compressed by tumors outside of it, or drawn out of place, bent, and fixed at an angle by contracting adhesions, the result of peritonitis. It may be obstructed by small polypi. In twin cases, each ovum may interfere with the passage of the other through the tube, hence twins are *relatively* more

frequent in tubal pregnancies than in normal ones. Fright during coition is an alleged but doubtful cause. Tubal pregnancy is more apt to occur after than before thirty years of

FIG. 71.



Pregnancy in the external third of the left tube. (From PARVIN, after WINCKEL.)

a. Ovary. b. Left tube. c. Tubal gestation cyst. d. Adhesion.

FIG. 72.



Tubal pregnancy with corpus luteum in opposite ovary. Some decidual membrane is dangling from the incised uterus. (From REYNOLDS and NEWELL, after PLAYFAIR.)

age, and also after prolonged sterility. Occasionally a fertilized ovum from *one* ovary migrates across to enter the tube

of the *opposite side*, but it may then have grown too large to pass, and becomes arrested in the tube. (See Fig. 72, page 202.)

Prognosis and Termination of Tubal Cases.—All forms of extra-uterine pregnancy are extremely dangerous. *If let alone* more than two-thirds of the cases die. By proper treatment many are saved. The usual explanation of this fatal result has been, until recently, that the tube is distended by the growing ovum until it bursts; then follows a dangerous or fatal hemorrhage from the ruptured tube. But the explanation is not thus simple. Only about one-fourth of the cases end in *rupture*; the other three-fourths terminate in *tubal abortion*, by which we mean discharge of the ovum from the tube through its abdominal ostium into the peritoneal cavity. Here again hemorrhage occurs from the aborting tube into the peritoneum, just as we have hemorrhage into the vagina from an aborting uterus. Neither *tubal abortion* or *tubal rupture* occur from simple *distention* of the tube from growth of the ovum. The sequence of events is rather as follows: the phagocytic trophoblast cells of the ovum, by their so-called “*corrosive*” action, eat into and through the tubal mucosa (the Fallopian decidua) and may even penetrate through the muscular coat to the peritoneum, thus dangerously weakening the wall of the tube. During this corrosive process, *blood vessels are opened* and blood is effused into the tube, insinuating itself between the fetal chorion and tubal wall, thus causing their separation, with still more and more hemorrhage and accumulation of extravasated blood within the tube. Thus the cause of distention is not *simply* growth of the ovum (though this contributes a share in the process), but accumulation of effused blood. Under these circumstances, if the ostium abdominale of the tube be open, the ovum is expelled (*tubal abortion*); if the opening of the tube be closed or obstructed, its rupture takes place. Muscular contractions in the wall of the tube (Fallopian “labor pains”) are, of course a contributing factor in both processes; or may be so. *Tubal abortion* occurs chiefly during the first and second months of pregnancy; a few cases during the third and fourth months. Thus of 61 cases recorded by Mackenrodt and Martin, 21 occurred in the first month, 29 in the second, 8 in the third, and 3 in the fourth. Rupture of the

tube occurs most often during the third and fourth months. A few cases occur later, and some have gone on to full term.

When tubal abortion occurs during the first two months, the embryo dies, disintegrates, and disappears by absorption. After then, when the placenta is formed and is not detached from the tube, the embryo may be discharged (either by rupture or abortion) into the peritoneal cavity, but maintains its connection with the placenta by its umbilical cord and so continues to develop—even to full term—in the abdominal cavity, constituting the “*abdominal*” variety of extra-uterine pregnancy. This is known as *secondary* abdominal pregnancy.

FIG. 73.



Tubal abortion. *o.* Ovum being expelled. *f.* Dilated os abdominale. *a.* Ampulla. *i.* Isthmus of tube. (From JELLETT, after BUMM.)

A *primary* abdominal case is one in which the fertilized ovum never enters the tube, but *begins* its development in the peritoneum. Recently it has been questioned whether such a “primary” case is possible; a few undoubted instances have, however, been recorded.

Broad-ligament Pregnancy.—Sometimes (“once in 50 cases,” *Williams*) when a tubal pregnancy ruptures, the rent occurs in the under surface of the tube *not* covered by peritoneum, hence the contents of the tube (ovum and extravasated blood) do *not* go into the peritoneal cavity, but are received between the anterior and posterior layers of the broad ligament. These layers being normally united to each other by connective tissue, offer considerable resistance to the intruding contents of the ruptured tube; hence hemorrhage

is restrained, the extravasated blood becomes a limited, circumscribed hematoma, and the danger of death from hemorrhage is much less than when the rupture and bleeding go freely into the large peritoneal cavity. Should the placenta remain well attached to the tube, the case may go on to term; the peripheral margins of the placenta extending beyond the tube attach themselves to the connective tissue of the broad ligament folds as the organ grows. But everything is *outside* the peritoneal cavity; though unfortunately it may not remain so, for the broad ligament foetal sac may itself rupture later on and discharge its contents into the peritoneum; thus the case becomes finally a *secondary abdominal* pregnancy, the condition now being much the same as when the tubal case originally ruptured into the peritoneum, as previously described.

Tubo-uterine Pregnancy.—An ovum developing in that part of the tube passing through the uterine wall gradually protrudes as it grows, into the uterine cavity, hence part of it is in the tube, and part in the uterus.

Tubo-abdominal Pregnancy.—An ovum developing in the fimbriated end of the tube may in like manner project itself into the peritoneal cavity where it forms adhesions with contiguous organs; thus it is partly in the tube and partly in the peritoneum.

Tubo-ovarian Pregnancy.—Here the implantation of the ovum was at first either in the tube or on the ovary (the two organs perhaps having been previously adherent to each other), and as it grows, necessarily invades both structures and becomes attached to both ovary and tube.

In any of these cases, what becomes of the foetus when it dies? If it die in the unruptured foetal sac during the first two months, it rapidly disintegrates and is *absorbed*. If it die there later it may become shrunken and *mummified*; or it may be converted into a *lithopædion*, or it may degenerate into a yellowish, greasy, soapy substance known as *adipocere*. In either of these three conditions the ovum may remain dormant and harmless for months and years, even during a long life; but there is always danger of a more disastrous event, viz.: *suppuration*. The foetal sac becomes infected with micro-organisms (supposedly by migration of bacteria from the intestine), pus forms, and the whole mass becomes an

abscess which bursts, discharging its contents into the vagina, bladder, or bowel, or externally through the skin. With the pus come the separated bones of the fetal skeleton, if the embryonic development have proceeded far enough to form one.

When a fetus has been discharged from its ruptured tubal sac into the peritoneum and dies, it is possible (should the woman survive) that it may become re-encysted by a capsule of inflammatory adhesions, where it may again remain (mummified, etc.) during a long life, or undergo suppuration and be discharged, as just previously described.

While these events are interesting possibilities, they are seldom met with nowadays, except in neglected cases where the fetus has not been removed by operation, as it should be.

Symptoms and Diagnosis of Tubal Pregnancy.—This abnormal condition is most often not suspected before symptoms of approaching rupture begin; sometimes not until actual rupture has taken place.

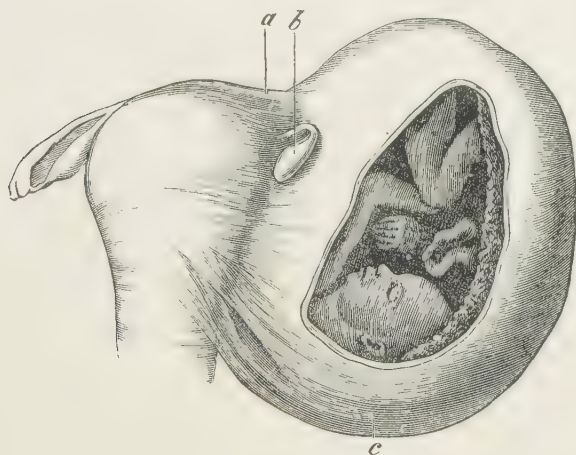
The *symptoms preceding rupture* are extremely important, but the diagnosis is difficult. The early signs of pregnancy exist. The menses are absent, but *reappear irregularly after one or two months*, leading the woman to doubt her supposed pregnancy. The discharge is mingled with *shreds* of broken-down uterine decidua. The womb is somewhat enlarged, but not as much as it should be in a normal pregnancy of the same duration. A tender and painful tumor (the tubal cyst) is discovered on the side of the uterus, in the vicinity of one of the broad ligaments. It grows rapidly; the womb does not. The tumor may be detected by the bimanual examination; it is somewhat soft and doughy, or fluctuating and extremely sensitive.

Should the vaginal finger recognize ballottement, the diagnosis is certain. Owing to pressure upon the bowel there may be *rectal tenesmus* in addition to constipation. Pressure upon vessel and nerves causes *œdema* and *pain in the limb* of the affected side; these occur earlier and are more severe than in normal gestation, and may be accompanied with slight elevation of temperature. The womb may be pushed on one side by the growing ovum. Eventually a severe, tearing, colicky, intermittent pain occurs in the region of the tumor, produced by contractions of the wall of the tubal cyst; the "miniature

Fallopian uterus" is irritated to contract by distention; it is having "pains"; but since there may be no outlet for its contents, it bursts.

Symptoms of Rupture.—Severe and sudden abdominal pain, with intense collapse, pallor, feeble and frequent pulse, etc. Rapid swelling of the abdomen, low down, and at first on the side occupied by the tumor; later, all over. The swelling is soft and doughy; it is produced by blood effused into the peritoneum. Syncope, nausea and retching, cold sweats, and subnormal temperature. The same symptoms occur in tubal abortion when hemorrhage is severe.

FIG. 71.



Pregnancy in right tube. Partially intra-ligamentous. (From PARVIN, after ZWEIFEL.) *a*. Right tube. *b*. Ovary. *c*. Gestation cyst with fetus.

Treatment of Tubal Cases before Rupture.—When surgical skill is available the proper treatment is cœliotomy. After thorough cleansing and sterilization of the abdomen and pubes, as well as of the instruments and hands of the operator and assistants, the bladder is emptied and the patient anesthetized. An incision three inches long is then made in the median line above the pubes down to the peritoneum, any bleeding vessels being twisted before opening the peritoneal cavity. The

peritoneum is then incised ; the intestine kept back by pads of cotton or gauze wrung out of the sterilized water ; the operator's fingers bring out the distended tube and ovary at the incision after having freed them from any existing adhesions ; the pedicle is then transfixed by a double ligature of sterilized silk, and each half of it tied securely according to surgical rule. The pedicle is cut, and the entire mass—tube, fetal cyst, and ovary—removed. The pads are then withdrawn and the abdominal incision closed and dressed in the usual manner. In case of threatened collapse from hemorrhage during the operation, the peritoneal cavity may be flooded with a 1 per cent. sterilized solution of common salt at a temperature of 100° F., a quart of this solution having been previously prepared. It is rapidly absorbed by the peritoneum, and acts as a restorative—like transfusion.

The device of *killing the fetus* to stop its growth, and thus forestall further distention and rupture of the cyst—by the various methods of (1) aspiration of the liquor amnii ; (2) injection of morphia, etc., into the amniotic sac ; and (3) by electricity—has, for good reasons, been abandoned. The first two methods are no longer thought of. That of destroying the life of the fetus by electricity, while inadvisable, might still be worthy of consideration when surgical skill was unobtainable or the patient and her friends refused surgical interference. The method of procedure is as follows : A faradic current is passed through the cyst in a series of sharp shocks, and repeated every day till diminution in the size of the tumor and retrograde changes in the breasts indicate fetal death. One pole (the negative) is passed into the rectum or vagina and placed in contact with the tumor, while the positive pole is applied on the abdomen. Electricity should *not* be used when there are signs indicating impending rupture ; it would hasten that unhappy event.

Treatment after Rupture.—Cœliotomy is here unquestionably the best method to pursue. The abdominal cavity should be opened by incision, the Fallopian tube, with the cyst, fetus, ovary, and effused blood, removed, in the manner just previously described for cases *before* rupture, extra care being taken, in the ruptured cases, to *quickly* secure the bleeding vessels of the ruptured tube from further hemorrhage. The sterilized salt solution may be used to recuperate the patient

from collapse, as in cases operated upon before rupture just previously described; the operation to be performed with the strictest antiseptic precautions. In forty-two operations performed *immediately* after rupture by Lawson Tait, thirty-nine women were saved. Hirst, of Philadelphia, had twenty-four consecutive cases without a death that could be ascribed to the operation itself. He advises, after the tube, ovary, and cyst are removed, that the abdomen should be flushed with large quantities of hot sterile water and drained with both a glass tube and gauze packing, both of which are removed after 48 hours, a rubber tube having first been passed through the glass one to take its place. For about ten days the abdominal cavity receives, through this rubber tube, a daily irrigation with hot sterile water, until it comes away clear from any flakes of blood-clot or decidual débris. His patients had no fever, and "every wound healed promptly within three weeks," without any persistent sinus. Lack of surgical address, daring, and skill, the want of surgical instruments and antiseptic appliances, and the dread of operating upon women almost at the door of death will doubtless continue, as in the past, to prevent the performance of this operation in many cases where it ought to be done. In some cases, after opening the abdominal cavity, the foetal cyst may be found so firmly and extensively adherent to adjoining viscera and other tissues as to render its removal extremely difficult and dangerous or even impossible. Enucleation of the sac should here not be attempted. In some of these cases it may be stitched to the abdominal wound, emptied of its contents, washed out with a weak bichloride solution (1 : 20,000), and packed with iodoform gauze. In other cases where the sac is low in the pelvis and easily reached through the vagina it may be opened through that canal, cleared of its contents, washed out, and packed with gauze, leaving a free opening for drainage. In doing both an abdominal and vaginal operation on the same occasion the hands of the operator must, of course, never pass from the vagina to the abdominal wound without thorough disinfection. It would be best to have the abdominal incision closed by the uncontaminated hands of an assistant. Should no operation be attempted, the only remaining treatment is that of expectancy—a forlorn hope. The woman must be kept absolutely at rest; opium given to relieve pain; stimulants to prevent

collapse ; with ice to the abdomen and compression of the aorta to control hemorrhage. There is a bare chance the bleeding may stop and the fetus become re-encysted by a wall of inflammatory exudation, and so remain harmless,¹ or be discharged later by abscess and bursting of the cyst, either externally or into some neighboring viscus, as already explained.

In cases of tubal pregnancy that have advanced to the later months, we have to deal with a placenta and sometimes with a living and viable child. The child should be removed by celiotomy and, if alive, the placenta should be left alone, the cavity of the fetal sac being packed with gauze, a part of which protrudes at the lower end of the abdominal incision, for drainage. To attempt removal of the placenta would endanger a fatal hemorrhage. In a few days (the placental vessels having now become occluded) the abdominal incision may be reopened, the gauze removed and placenta extracted with less danger of bleeding. Should the child have been dead some days *before* the celiotomy operation, the placenta may be removed without fear of great hemorrhage at the time the child is extracted. (See *Treatment of Abdominal Extra-uterine Cases*, page 216.)

INTRA-LIGAMENTOUS PREGNANCY (EXTRA-PERITONEAL, SUBPERITONEO-PELVIC, SUBPERITONEO-ABDOMINAL).

This is the variety of tubal pregnancy in which the tube ruptures between the layers of the broad ligament—between two *external* surfaces of peritoneal layers, not into the peritoneal cavity, as before explained (p. 204). The effusion of blood is restricted by these layers of broad ligament and the connective tissue uniting their apposed surfaces. Hence the hemorrhage is less likely to be rapidly fatal, constituting a limited hæmatocele, which may become absorbed, leaving a lithopædion, or develop into an abscess later on. The newly formed hæmatocele *may*, however, undergo a *secondary* rupture through the distended broad ligament and *into* the peritoneal cavity.

Diagnosis.—The diagnosis of intra-ligamentous cases depends chiefly upon the collapse from hemorrhage being *less*

¹ Virchow (Cellular Pathology, p. 325) found the muscles of the fetus perfectly intact after remaining thirty years in the body of the mother.

severe, and upon the recognition of a *rapidly formed* but still circumscribed *tumor* independent of the uterus, in which may be felt fluctuation and perhaps pulsating vessels. This tumor is formed by clots of effused blood *circumscribed* between the folds of broad ligament, quite different from the doughy enlargement *diffused* over the whole abdomen when hemorrhage has taken place inside the peritoneal cavity. Moreover, rectal examination shows Douglas' *cul-de-sac* to be *empty*, while in the intra-peritoneal cases it is *filled* with effused blood.

Treatment.—Surgical interference not immediately necessary. By rest and recumbency, with treatment for the anæmia following the moderate hemorrhage, the effused blood may be absorbed, and the woman recover. Later on suppuration may occur, with symptoms of sepsis,—chills, fever, rapid pulse, vomiting, etc.,—when abdominal section will be required. It is in these broad-ligament cases that entire removal of the cyst will often be difficult and dangerous, and when it will be better to open the sac and stitch it to the abdominal wound, as just previously explained.

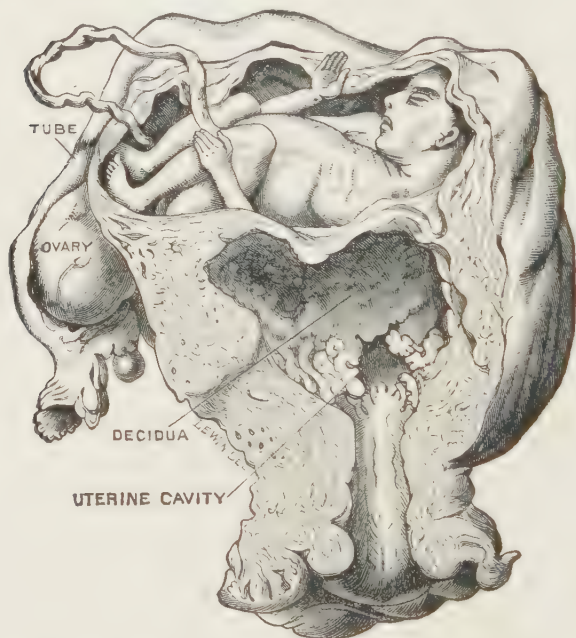
INTERSTITIAL PREGNANCY (TUBO-UTERINE).

The ovum is in that part of the tube passing through the uterine wall. Extremely rare. Rupture may occur into the peritoneum; or that surface of the foetal cyst toward the interior of the womb may rupture and the foetus escape into the uterine cavity, and come out by the natural passage. It is less fatal than tubal pregnancy, and may rarely advance to full term. Differential *diagnosis* from other varieties very uncertain. The womb is irregularly enlarged, and to a greater *degree* than in the other varieties; the tumor moves with the uterus; the uterine cavity is empty. Possibly the finger *in utero* may recognize the bulging wall of the foetal cyst and its contents. Abdominal section may be required before the diagnosis can be made positive.

Treatment.—When the foetal cyst bulges in toward the uterine cavity, the cervix uteri may be dilated, the cyst incised, and its contents evacuated through the vagina, the sac being afterward cleansed antiseptically and packed with iodoform gauze. When the cyst bulges the other way, toward the outside of the uterus, an abdominal section should be

made ; the cyst opened and emptied ; the edges of the opening sutured to the wall of the abdomen ; the bleeding vessels secured and the sac drained through the abdominal incision. Should this be found impracticable, the opening made in the peritoneal surface of the cyst may be securely stitched up (as

FIG. 75.



Interstitial or tubo-uterine pregnancy. (From PLAYFAIR, after BLAND SUTTON.)

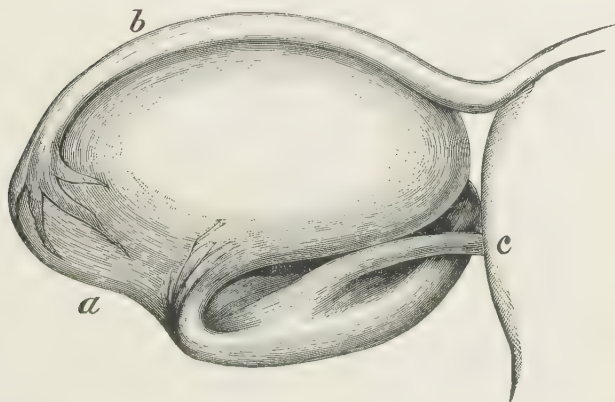
in an ordinary Cæsarean section operation), a counter-opening having been previously made, for drainage, from the cavity of the cyst into the cavity of the uterus, the abdominal incision being then closed without drainage. The cervix uteri should, of course, have been thoroughly dilated beforehand.

Another device is Porro's operation : take out the entire uterus with its contents, by supra-vaginal amputation, through the abdominal route.

OVARIAN PREGNANCY.

Its occurrence has been disputed, but a few cases have undoubtedly been observed. The ovisac (Graafian vesicle) ruptures without the ovule escaping; spermatozoa enter through the rent, hence impregnation and gestation begin in the ovary. The wall of the ovisac and stroma of the ovary

FIG. 76.



Ovarian pregnancy, left side. Only part of the ovary participates in the gestation cyst. (From PARVIN, after WINCKEL.) *a.* Ovarian pregnancy. *b.* Left tube. *c.* Uterus.

dilate to form the foetal cyst; but gradual distention may force the ovum partially out of the ovary and into the peritoneum, the portion escaping being circumscribed by peritoneal adhesions. Rupture usually occurs within three or four months, with the several results usually produced by rupture of tubal cases. Differential *diagnosis* well-nigh impossible. *Treatment*: practically the same as for tubal gestation.

ABDOMINAL PREGNANCY.

In these cases the ovum is neither in the womb, tube, nor ovary; it is in the cavity of the peritoneum; its growth is not curtailed by any resisting muscular wall. The pregnancy

therefore may, and usually does, go to full term—a history surprisingly different from the rupture occurring in other varieties previously described. The placenta has been found attached, in different cases, to all parts of the peritoneum; to that covering the uterus, the bladder, the colon, the small intestine, the mesentery, the stomach, the kidney, the omentum, the lumbar vetebæ, etc.

Abdominal pregnancy is said to be *primary* when the impregnated ovule, failing to pass from ovary to tube, drops

FIG. 77.



Uterus and foetus in a case of abdominal pregnancy.

down into the cavity of the peritoneum, and attaching itself to that membrane, begins there its primary development. The existence of this variety has been denied and thought to be impossible; it is said that the peritoneum would digest the ovum, etc. But that impregnation may really occur in the abdominal cavity is shown in a case where the body and part of the neck of the uterus had been removed, the ovaries remaining. Semen passed in through a fistulous opening in the stump of the cervix, and abdominal pregnancy followed.

Most cases of abdominal pregnancy are said to be *secondary*, that is to say, they begin as tubal, ovarian, interstitial, or

intra-ligamentous cases, and after rupture become, *secondarily*, abdominal cases. The ovum remains partly connected with its first sac, but wherever it touches the peritoneum a proliferation of connective tissue occurs, and so the sac is enlarged and continues to grow, forming adhesions to various visceral layers of peritoneum. More rarely there are no restricting pseudo-membranes, the ovum, surrounded by its amnion and chorion, being free in the abdominal cavity. And still more rarely the amnion and chorion may *also* rupture, leaving the child loose in the cavity of the abdomen. It then usually dies, but exceptionally does not, but pursues its development in a new sac of proliferated connective tissue.

Symptoms and Diagnosis.—Nothing special occurs during the early part of pregnancy, except that the uterus does not enlarge correspondingly with the duration of pregnancy. Attacks of pain in the abdomen may occur, with fever, due to local peritonitis and stretching of adhesions, and sometimes pain is produced by foetal motions. Most cases progress without other remarkable symptoms; sometimes there may be partial rupture of the cyst, with moderate bleeding and prostration, and subsequent recovery. Late in pregnancy the movements of the child are more easily felt, and the sounds of its heart more distinctly heard than in normal pregnancy. The foetal parts may sometimes be distinctly felt through the posterior vaginal wall, in Douglas' *cul-de-sac*. This, however, may also occur in cases of bisacculated uteri, but here the position of the os and cervix uteri would aid the diagnosis. (See Chapter VIII., p. 172, Figure 70). Small size of the uterus precludes the possibility of its containing the foetus. At full term labor-pains begin—uterine contractions—with discharge of the uterine decidua and some blood, and the foetus, till now alive, well, and normally developed, soon dies. It may remain for many years without change; or become partially absorbed, leaving a lithopædion; or again, which is most common, the cyst becomes inflamed and suppurates, the child breaks up, decomposes, and the whole contents of the abscess are discharged through fistulous openings into the adjoining visceral cavities, or externally through the skin, the woman being liable to death from exhaustion, septicæmia, etc. In cases where a diagnosis is *almost* certain, it is permissible to make it *quite* so by passing a finger through the dilated

os uteri, thus demonstrating the emptiness of the uterine cavity.

Treatment.—In abdominal pregnancy we often have to deal with a *live* child and with a developed *placenta*, this latter *not* being attached to any muscular structure—like the wall of the uterus—which will contract and prevent bleeding after separation, hence danger of hemorrhage.

If the child be alive, and the woman present no very serious symptoms, nothing might be done until near full term. Then, one of two courses is available; either “*primary caeliotomy*”

FIG. 78.



Lithopædion. (From PLAYFAIR.)

before the child dies, and in order that it may be extracted alive; or “*secondary caeliotomy*” some weeks, or even months, after its death. Which is the better plan has long been a matter of discussion, and still remains unsettled. By the primary operation the child is sometimes saved, but the risk to the mother—10 maternal deaths in 40 cases—is so great (chiefly from hemorrhage at the placental site) that secondary caeliotomy has been until recently preferred. Lately, with improved methods of operating, the primary operation is growing in favor, and the chance of saving both child and mother

increased. When the child has died, whether at term or before, there should be no operation for at least a month or even much longer, provided no symptoms of septicæmia arise. This delay allows obliteration of the placental vessels and lessens the risk of hemorrhage during and after the operation. So long as the dead child remains, however, the risk of septicæmia remains also. Delay must be measured by the case, not by rule. Some advise the abdomen to be opened "as soon as the placental circulation has ceased, as certified to by the absence of placental murmur." The *operation* (with all aseptic precautions) is done by making an incision in the linea alba. Should the foetal sac not be adherent to the abdominal wall it must be stitched to the incised surfaces of the wound before being opened. When opened the child is removed, the funis cut off close to the placenta, but the placenta *left undisturbed*. The sac is packed with aseptic gauze, a part of which is allowed to protrude at the lower end of the abdominal incision, for drainage. In a few days the placental vessels will have become obliterated, or the placenta itself separated from its attachments, when the abdominal incision may be again opened and the placenta removed. To attempt separation of the placenta insures immediate and dangerous hemorrhage. Even when it is left, hemorrhage may occur later. An improved mode of operating has been successfully practised to avoid both the danger of hemorrhage and septicæmia. It consists in *exsecting* the entire *cyst* and *placenta* at once, not by tearing or peeling them away, but by first clamping and then ligating, bit by bit, all vascular connections of the cyst and placenta, the parts tied by the ligatures being then severed by incision. This method will probably supersede that of leaving the placenta undisturbed. At present the matter is unsettled.

When, in neglected cases (without cœliotomy), the foetus and liquid contents of the cyst are being gradually discharged through fistulous openings, these openings should be enlarged by careful stretching with steel dilators, antiseptic washes thrown in, free drainage secured, and pieces of bone or other obstructing débris removed by manipulation. The woman is given iron, quinine, food, and stimulants to prevent exhaustion, and opiates to relieve pain.

HYDATIDIFORM. PREGNANCY. (CYSTIC DEGENERATION OF THE CHORIAL VILLI. MYXOMA OF THE CHORION. VESICULAR MOLE.)

The fetus dies *early*, dissolves, and disappears, or may be found as a shrunken remnant of its former self, surrounded by its amnion and the degenerated chorion. The villi—the bulbous ends of their branches—become distended with fluid into little sacs or cysts of different sizes, which continue to increase in number till the uterus is filled. Technically, the disease is *cystic* (or dropsical) *degeneration of the chorial villi*. The cysts hang by long, narrow pedicles, like diminutive elastic pears, or dangle from each other, suggesting a resemblance to serpent's eggs. Viewed *en masse*, they look like a bunch of grapes, but their branching stalks are not derived, like a bunch of grapes, from one main stem, but one cyst is joined by its pedicle to another, and this again to another, until the final pedicle is traced to the membrane of the chorion. Some of the cysts are half an inch in diameter or a little over—most of them much smaller. (See Fig. 79.)

The idea has long prevailed that the disease was a myxomatous degeneration of the mesoblastic core in the *interior* of the villi, but more recently it has been demonstrated that the epithelial *coverings* of the villi—the layer of Langhans and the syncytium—are chiefly concerned. While the inner substance of the villi does undergo a myxomatous degeneration with obliteration of the fetal capillary loops, it is really the rapid proliferation and increased activity of the cells of Langhans and of the syncytium upon which the development of a vesicular mole chiefly depends.

The degenerated villi may penetrate deeply into the muscular wall of the uterus, even to the peritoneum, and thus lead indirectly to rupture of the uterus. In some cases of twins the chorial villi of one fetus may degenerate, while those of the other do not—the latter child reaching, possibly, full development. In other cases only a part of the villi becomes diseased, enough remaining healthy to form a placenta, and the pregnancy goes to full term with a well-formed child. The degenerative process usually *begins* during the first month of pregnancy; its commencement is seldom postponed later than the third month.

Causes.—It has been ascribed to constitutional syphilis, morbid changes in the decidua, early death of the fetus, etc., but the question is still unsettled.

It has been called *hydatidiform pregnancy* from a crude resemblance to, and a former *erroneous* supposition that the cysts were identical with, *true* hydatids (entozoa, acephalocysts), such as occur in the liver and other organs (possibly in the uterus), but which have nothing to do with impregnation, or an ovum.

FIG. 79.



Hydatidiform degeneration of the chorionic villi.

Remnants or repeated new developments of the growth may appear months or even years after impregnation. In women separated from their husbands, unpleasant complications might thus arise, and the case assume medico-legal importance.

Diagnosis of True Hydatids from Hydatidiform Pregnancy.

—In true hydatids the cysts develop, some *inside* of others,

and the echinococci heads and hooklets may be seen with the microscope. This microscopic appearance is wanting in hydatidiform pregnancy, in which, also, we have seen the cysts hang by stalks and increase by a sort of budding process—not inside each other.

Symptoms of Hydatidiform Pregnancy.—The early signs of pregnancy follow impregnation as usual; but there are no positive or physical signs, for the child dies before the tenth week—often much sooner. Then follows extreme rapidity of uterine enlargement. At six months the womb is as large as at full-term pregnancy. It is unsymmetrical in shape; it is doughy or boggy to the touch, and no fetus can be felt in it. Overdistention, between the fourth and sixth months, occasions obstinate vomiting, and eventually leads to contraction of the womb, accompanied with gushes of transparent watery fluid, from crushing and bursting of cysts. Hemorrhage—severe hemorrhage—may also occur.

Diagnosis is confirmed by finding characteristic cysts in the discharges, or the mass may have been previously felt in the os uteri.

Prognosis.—Generally favorable. Mortality 18 per cent. The chief danger is hemorrhage. In rare cases rupture of the uterus may occur, with consequent hemorrhage into the peritoneal cavity, peritonitis, septicæmia, and death.

Treatment.—Empty the uterus and secure its contraction as soon as safely practicable. Give ergot. Open the os uteri, if necessary, with a Barnes or other dilator, and with the fingers or hand, or half hand in the uterus, carefully extract the mass. *Beware of rupturing the uterine wall; it may be very thin*, especially in advanced cases with great distention. While the os is dilating a tampon may be necessary to check hemorrhage. Instead of using the hand, the mass may be broken up with a male metal catheter, and left to be expelled by uterine contraction, especially when the os is undilated, a tampon being used to control hemorrhage. In no instance should the curette be used, owing to danger of its penetrating the thin uterine wall.

In case the child is demonstrated to be alive (as in the rare instances of twins previously mentioned), an attempt may be made to control hemorrhage without emptying the uterus; but should this not succeed, and the life of the woman be

jeopardized, the rule of removing the hydatidiform mass must be adhered to, whether the healthy ovum be disturbed or not.

After emptying the uterus its cavity should be washed out with a carbolic solution. If bleeding continue, tampon the uterine cavity with iodoform gauze. To prevent recurrence of the growth, Barnes recommends painting the inside of the uterus with tr. iodin, one part, to glycerin, five parts, once a week for several weeks. Should there be any *offensive* discharge, wash out the uterus with some antiseptic solution and insert a suppository of iodoform.

In cases where a diagnosis has been made early in pregnancy, or even later, but *without any uterine contractions* or hemorrhage, it will be best to dilate the os uteri, bring on labor, and empty the womb, and thus lessen the danger of hemorrhage, which increases with the duration of pregnancy.

While the ancient idea that all cases of cystic degeneration of the chorion were malignant has been long ago abandoned, recent investigation has shown that there is an intimate relation between malignant disease of the placental site and cystic disease of the chorion. So frequently, in fact, does that most rapidly fatal form of cancer—*deciduoma malignum*—follow hydatidiform mole that its occurrence should be born in mind as a possible thing in every case. The disease will now be considered in a separate section.

DECIDUOMA MALIGNUM (CHORIO-EPITHELIOMA MALIGNUM).

The first term implies that the disease begins in the decidua, hence a *maternal* growth ; the second, that it originates in the chorial villi, hence a *fatal* growth. The latter is probably correct, though this is unsettled ; it may be either or both. A dozen other synonyms have been used.

It may occur after labor and abortion, but about 45 per cent. of the cases follow hydatidiform mole. In 128 cases collected by Ladinski, 51 followed mole, 42 followed abortion, 28 labor at term, 4 premature labor, and 3 tubal pregnancy.

Symptoms.—Recurrent hemorrhages from the uterus, and a more or less foul watery discharge, coming on days, weeks, and even months after labor, abortion, or discharge of the vesicular mole.

A finger passed through the usually patulous os uteri finds in the enlarged uterine cavity projecting masses of soft friable tissue that may be easily broken off and extracted for microscopical examination. It is only by the microscope that an absolutely *positive* diagnosis can be made. The importance of this sure method of diagnosis cannot be overestimated, for *early* extirpation of the uterus is the patient's *only* hope of life.

When expert microscopic evidence is unavailable, there are other symptoms on which it would be justifiable to do a hysterectomy rather than risk the woman's life by delay. Thus hemorrhages and a foul discharge, owing to retention of secundines after an ordinary labor or abortion, and *without* any malignancy, are *permanently* relieved by curettage; while in deciduoma malignum the uterine cavity, after being scraped out, *rapidly fills up again* (sometimes even within a few days or weeks) with the malignant growth, and the symptoms recur.

Another not uncommon symptom is spitting of blood—*hæmoptysis*. This is due to metastasis of cancer cells from the uterus to the lungs. The disease is remarkable for its numerous and *very early* metastases, thus producing secondary growths in the lung, liver, pancreas, pleura, kidney, spleen, heart, diaphragm, ribs, pericardium, and brain. Sometimes secondary growths are found in the vaginal wall, or in one of the labia majora, presenting a projecting friable mass like those in the uterus.

Treatment.—Hysterectomy, *early* complete extirpation of the uterus, is the only hope. Otherwise, death in from three to six months.

FIBRO-MYXOMATOUS DEGENERATION OF THE CHORION.

Very rarely the interior stroma of the chorial villi becomes more or less solid from the development of fibrous tissue; this may go on to form scattered nodules throughout the placenta, or give rise to one placental tumor of considerable size. It may or may not be accompanied with symptoms requiring treatment by the curette and gauze packing to arrest hemorrhage.

MOLES.

Moles are masses of some sort, developed in and expelled from the uterus. If the growth result from impregnation, it is called a "true" mole; if it occur independent of impregnation, it is a "*false*" mole.

True moles: The hydatidiform pregnancy just described is a true mole. Another form—the "*fleshy mole*" occurs after early death of the fœtus, from a sort of developmental metamorphosis of the fœtal membranes, mingled with semi-organized blood-clots, so as to form a more or less solid nondescript fleshy mass. Chorial villi may generally be discovered in it with the microscope.

Portions of the fetal membranes, or of the placenta, may be left after abortion, and develop into true moles.

False moles: An intra-uterine polypus, or *fibroid tumor*, or *retained coagula of menstrual blood*, or a *desquamative cast of mucous membrane* from the uterine cavity (membranous dysmenorrhœa), may be expelled from the womb, with pains and bleeding resembling those of abortion or labor. Examination of the mass, its history, and absence of chorial villi, will be sufficient to indicate a correct diagnosis, and shield the female, if unmarried, from any undeserved suspicions.

A desquamative cast from the *vagina* may occasionally occur.

These are so-called false moles; they seldom attain any considerable size.

Treatment consists in securing their complete expulsion by ergot, digital manipulation, or curetting. In cases of fibroid tumors or polypi the usual surgical methods may be necessary for their removal.

DROPSY OF THE AMNION (HYDRAMNION, HYDRAMNIOS, POLYHYDRAMNIOS).

The normal quantity of liquor amnii (one to two pints) may be increased to five, ten, and even twenty or more pints. This is *hydramnion*.

Causes.—Causes not thoroughly understood. In some instances the cause is interference with return of blood to fœtus

through umbilical vein, either from pressure on the cord (as in twins or triplets) or from disease of fetal heart, lungs, or liver, obstructing circulation; hence association of hydramnion with syphilitic disease of liver of fetus. Excessive secretion from the kidneys or from the skin of the fetus. Acute cases sometimes follow blows upon the abdomen, with supposed inflammation of the amnion itself. Thinness of the mother's blood may produce it. There are numerous other theoretical explanations. It is seldom observed before the fifth month.

Symptoms.—Abdomen unnaturally large from overdistended uterus; increase in size and weight of the latter lead to dyspnoea and palpitation, vomiting, dyspepsia, insomnia, and oedema of labia and lower limbs, together with neuralgic abdominal pain and difficult locomotion. In cases of *gradual* accumulation of fluid these symptoms may be unexpectedly moderate. Very rarely the disease occurs in an *acute* form, with fever, *rapid* instead of gradual distention of the uterus, and consequent intense abdominal pain, extreme dyspnoea, cyanosis, and distressing emesis.

Hydramnion may lead to or be associated with ascites.

Diagnosis.—The uterine tumor will be found, on palpation, elastic and tense, with indistinct fluctuation, becoming more distinct as the distention increases. The fetus is very movable, changing its position frequently; its heart-sounds are faint or inaudible. The history of pregnancy is an important element in diagnosis; it is sometimes overlooked. Twin pregnancy differs from hydramnios in presenting on palpation the solid irregular projections of the two fetuses. An overdistended bladder is differentiated by the catheter. Distention of the abdomen from pregnancy associated with cystic tumor of the ovary or broad ligament differs from hydramnios in presenting two tumors of different shape and consistency. In any case where the abdomen is enormously distended almost to its utmost capacity, a positive diagnosis may be impossible without an explorative abdominal section, or reduction of the fluid by puncture.

Prognosis and Treatment.—Death of the fetus and premature labor are apt to occur. One-fourth of the children are stillborn. Interference with respiration and other functions of the mother may endanger her life unless rupture of the sac occur spontaneously, or the fluid be discharged by *arti-*

ficially rupturing it, which is about all that can be done by way of treatment, and which, of course, ends the pregnancy. Attempts may be made to make only a small puncture of the amniotic sac high up between the membranes and uterine wall, so as to allow the fluid to run out gradually, and thus avoid premature labor. Tapping of the uterus through the abdominal wall, for the same purpose, has been repeatedly done, intentionally, in the interest of the child, and without any special harm to the mother, but the uncertainty of the child's life scarcely justifies the risk to her which is inseparable from such an operation.

When the fluid is suddenly evacuated, apply abdominal bandage to prevent syncope from rapid reduction of intra-abdominal pressure. During labor beware of uterine inertia and hemorrhage, malpresentation, and prolapse of funis.

DEFICIENT LIQUOR AMNII (OLIGOHYDRAMNIOS).

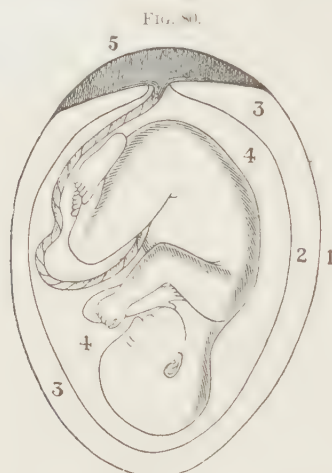
In the absence of sufficient liquor amnii to distend the amnion and keep it away from the fœtus, adhesions may occur between the fœtal skin and amniotic membrane—they grow together. In case the deficient fluid is restored later, these adhesions may stretch into bands or cords, producing deformities of the fœtus or amputation of its limbs. Two limbs, in contact with each other, may grow together when there is not enough liquor amnii to separate them and allow of their free motion. There is no *treatment*.

HYDRORRHŒA (HYDRORRHŒA GRAVIDARUM).

During the later months of pregnancy (sometimes earlier) women observe a discharge of fluid from the vagina—either a perceptible gush or a continuous trickle or dropping—which they think is due to rupture of the bag of waters; yet on examination the bag is found *unbroken*. The discharge may occur during rest, as after exercise or violence. It is usually due to *catarrhal endometritis*—inflammation of the mucous lining of the uterus. The fluid resembles liquor amnii both in odor and color, but is sometimes muco-purulent or tinged with blood. It accumulates between the chorion and decidua reflexa, until rupture of the latter membrane allows its escape,

perhaps in quantities of a pint or less; or it may be formed chiefly by the decidua vera, and escape gradually between that membrane and the decidua reflexa. Obstruction to the outflow at the internal os uteri, or adhesions between the decidua vera and reflexa, may again cause accumulation of the fluid and its discharge in quantity later on.

A few cases have been observed in which fluid accumulated between the chorion and amnion, as shown in Fig. 80 from J. B. Nichols' publication.



Afterbirth with double sac. 1. Outer sac—chorion and decidua. 2. Inner sac—amnion. 3. Chorionic cavity. 4. Amniotic cavity. 5. Placenta.

The discharge is distinguished from that following rupture of the amnion in that the latter only occurs *once*, and is followed by labor. Rare cases are, however, recorded of *amniotic hydroorrhæa* in which the *amniotic fluid* has gradually escaped, at intervals, for weeks or months before labor, through an aperture in the amnion high up in the uterus, far above the internal os. In one case the amnion had been punctured by an ill-formed foetal bone.

In any case, if the discharge be sudden and considerable in quantity, it may be followed by pain and premature labor. To

prevent this we enjoin *absolute rest* and an *opiate*, taking care to avoid the mistake of hastening labor, under the impression that the waters have broken, when, really, they have not. By this treatment (there is no other) pregnancy may go on to full term. The catarrhal endometritis can, of course, only be treated after pregnancy is over.

CHAPTER XII.

LABOR.

LABOR is the act of delivery or childbirth—parturition. The period after impregnation at which it takes place is ten lunar months or thereabouts (280 days). Children may be born alive earlier, as already explained, and exceptionally, the pregnancy may last as long as eleven or even twelve months. The *possibility* of these latter cases becomes important, considered in a medico-legal point of view. For predicting the date of delivery in a given case there are several methods. The best is that of Naegele, to wit: (1) Ascertain the day on which the last menstruation ceased; (2) count back three *calendar* months; (3) add seven days. For example: Menstruation ceased August, 1st, count back three months—*i. e.*, to May 1st—add seven days, which brings us to May 8th, the probable day of delivery. It is the same as, but easier than counting forward nine calendar months and adding seven days. To be *quite* exact, the number of days to be added will sometimes vary, as shown in the diagram constructed by Schulze. (See Fig. 81.) Thus, if after counting back three months we reach March, May, June, July, August, October, or November, the number of days to be added is *seven*; if April or September, *six*; if December or January, *five*; if February, *four*. Should the pregnancy include February of a leap-year, the figures contained in brackets are to be added, except when the counting back brings us into December, January, or February.

In cases where the date of the last menstruation cannot be ascertained, or in which the woman became pregnant while not menstruating, as may happen during lactation, etc., the period of delivery can be only approximately determined by noting the size of the uterus and the height to which the fundus has risen in the abdomen; thus estimating the present

duration of the pregnancy and the consequent number of additional weeks before full term. (See page 134, Fig. 66.) It may also be remembered that quickening is first noticed by the woman, *usually* about the middle of pregnancy (end of twentieth week) in primiparæ, and one or two weeks later in multiparæ; but there are many exceptions to this usual rule.



CAUSE OF LABOR AT FULL TERM.

A number of factors combine to provoke uterine contraction, chief among which may be mentioned gradual distention of the uterus near the end of pregnancy (not before) from the organ having reached the physiological limit of its growth, while the bulk of its contents still continues to increase.

Increased muscular irritability of the uterine walls and exaggerated reflex excitability of the spinal cord probably occur toward the end of pregnancy, so that the uterus is excited to contract more readily; while the stimuli to contraction, viz., distention, motions of the child, stretching of the uterine ligaments, pressure of the womb on contiguous parts from its own weight, and compression of it by surrounding peritoneal and muscular layers, are all exaggerated.

When the presenting part of the fetus distends and presses upon the neck of the uterus, contractions are excited (just as the bladder and rectum contract when their contents press upon and distend their respective necks), but, in labor, this is *after* the beginning, hence irritation of the sphincter (os uteri) cannot be considered the *primum mobile* of uterine contraction.

Forces by which the Child is Expelled.—The main force is that of uterine contraction, which derives its power chiefly by reflex motor influence from the spinal cord: the secondary or “accessory” force is contraction of the abdominal muscles and diaphragm. Uterine contraction is entirely involuntary, that of the abdominal muscles may be assisted by voluntary effort in the act of straining.¹

Labor Pains.—A labor pain is a contraction of the uterus lasting for a little time, and then followed by an interval of relaxation or rest. In the beginning of labor the pains are *short in duration* (thirty seconds or less); feeble in *degree*; the intervals are *long* (half an hour or more), and there is no contraction of the abdominal muscles, or straining effort. As labor progresses, in the natural order of things, the pains gradually increase in duration, strength, and the amount of straining effort, and the intervals between them become shorter, up to the moment of delivery. The longest pains seldom exceed one hundred seconds.

The *early* pains are called “cutting” or “grinding” pains, from the accompanying sensations experienced by the woman; and the later ones “bearing-down” pains, from the distressing tenesmus or straining by which they are attended.

In cases where there is no malproportion between the size of the head and pelvis, and other things are perfectly normal, there are still two great sphinctorial gateways which offer a certain amount of obstruction to the passage of the child, and the resistance of which must be overcome before delivery can

¹The nervous origin of the motor power of the uterus is still unsettled. Playfair (6th American edition) affirms that the fact of the uterine contractions being altogether involuntary “proves them to be excited solely by the sympathetic system” (p. 271), and that the motor centre for uterine contraction “is known to exist in the *medulla oblongata*” (p. 267). Foster (Text-book of Physiology, 3d edition, p. 703) says: “The whole process of parturition may be broadly considered as a reflex act, the nervous centre being placed in the *lumbar cord*.” On the other hand, it is well known that paralysis of the spinal nerves supplying the pelvic organs does not interfere with gestation or labor; and Hirst (Obstetrics, fourth edition, page 240) declares that labor is actually easier in women who have paraplegia, as if the spinal nerves exercised an inhibitory action upon the uterine muscle, the removal of which facilitated parturition.

take place; these are first, the *mouth of the uterus*; second, the *mouth of the vagina*.

The "Bag of Waters."—A natural arrangement is provided for the dilatation and opening of the resisting os uteri, by the gradual forcing into and protrusion through it of the most depending part of the amniotic sac, or "bag of waters." During labor-pains the contracting circular layers of uterine muscles compress the "bag" on all sides, circumferentially, thus tending to make it bulge out at the only point of escape (the os uteri); while the longitudinal muscular layers in the uterine wall shorten the womb, and thus tend to pull back or retract the ring of the os from off the bulging end of the protruding bag. The bag being soft, smooth, and elastic, can more completely fit and more easily dilate the os uteri than any part of the fœtus, hence the importance of not breaking it during the early part of the labor. The *weight* of the contained liquor amnii probably assists dilatation, the woman not being confined to a recumbent posture.

The bag of waters also protects the body of fœtus, placenta, and umbilical cord from the direct pressure of the uterine wall; and it allows the womb to maintain its symmetrical shape, thus lessening interference with the uterine and placental circulation.

THE STAGES OF LABOR.

Labor is divided into three stages; the *first* stage begins with the commencement of labor and ends when the os uteri is completely dilated.

The *second* stage immediately follows the first, and ends when the child is born.

The *third* includes the time occupied by the separation and expulsion of the placenta: it ends with safe contraction of the now empty uterus.

Premonitory Symptoms of Labor.—Sinking of the uterus, which usually occurs three or four weeks before term in primiparæ, and a week or ten days before in multiparæ, with consequent relief to cough, dyspnœa, palpitation, etc., as previously explained (pages 133 and 134). Increased frequency of evacuations from bowels and bladder from pressure on them of the now sunken uterus. Commencing and progressive obliteration

of the *neck* of the uterus. Occurrence of a viscid mucous discharge from the vagina (originating, however, chiefly in the cervix uteri) which may be tinged with blood; it is called "*the show*." This last lubricates the soft parts and prepares them for dilatation.

Intermittent pain in the womb, due to feeble contractions, may occur a few days before the actual commencement of labor—sometimes weeks before.

FIG. 82.



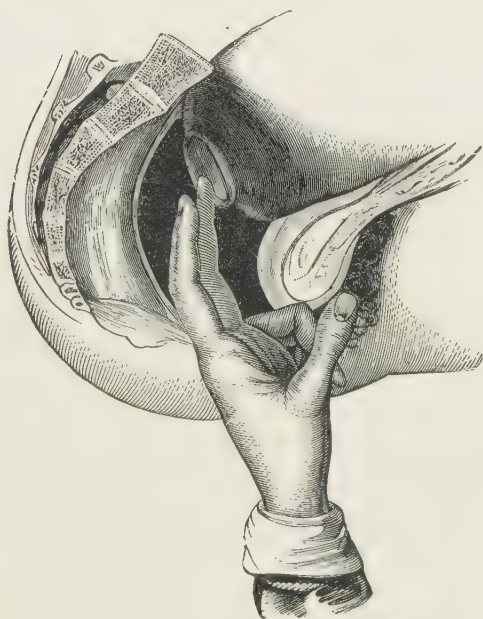
Commencing dilatation of the os uteri. Examination with index finger of right hand. (After PARVIN.)

Signs and Symptoms of Actual Labor.—The characteristic signs are: 1. Labor pains. 2. Commencing dilatation of the os uteri. 3. Presence, or increase if previously existing, of muco-sanguineous discharge—the "*show*." 4. Commencing descent into or protrusion through the os uteri of the bag of waters. 5. Rupture of the bag and discharge of liquor amnii;

6. Relaxation of external genitals. 7. The vocal outcry, expression, etc.

Phenomena of the First Stage.—Feebleness and infrequency of the first “cutting” pains. Suffering during them is referred chiefly to the back. The woman walks about, if not prohibited from doing so; is restless, despondent, perhaps slightly irritable from discontent at progress being slow.

FIG. 83.

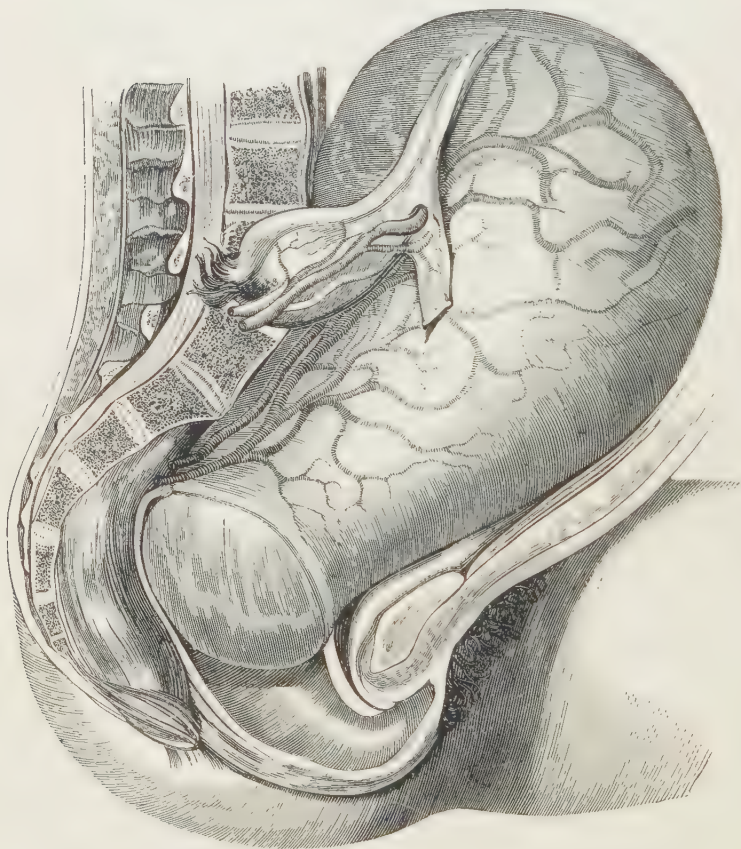


The os uteri more dilated. Examination by fingers of left hand. (After PARVIN.)

As dilatation of the os uteri progresses, the pains become “bearing-down” in character, and the pain in the back increases in severity. Nausea and vomiting occur during further dilatation, and probably assist it by producing relaxation. When dilatation is near completion slight “shudders” or even severe rigors occur, but without any fever. Full dila-

tation of the os uteri is usually announced by rupture of the bag of waters during a pain and an audible gush of liquor

FIG. 84.



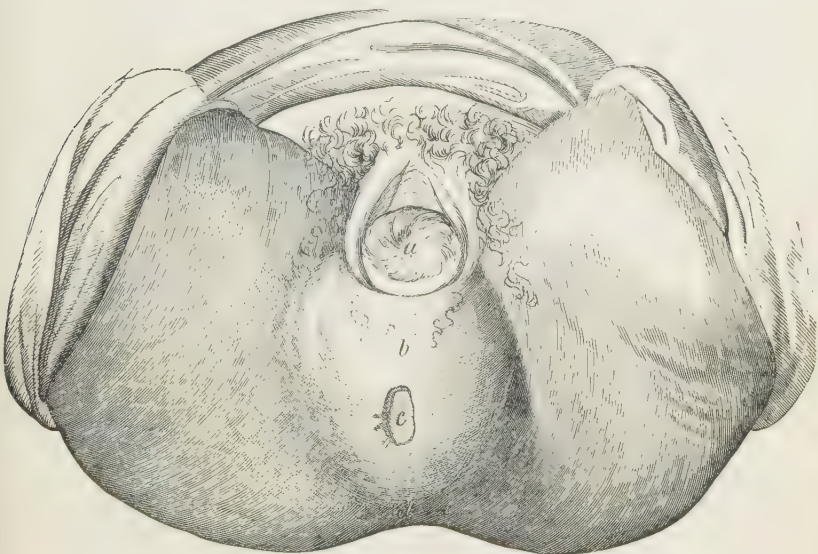
Complete dilatation of the os uteri. Bag of waters will soon rupture. (After PARVIN.)

amni.¹ On vaginal examination we find simply progressive

¹ By some authors, rupture of the bag defines the end of the first stage of labor; it may, however, precede dilatation.

dilatation of the os uteri and protrusion of the bag of waters. The presenting part of the child may be felt through the unbroken sac. The duration of the first stage varies much in different cases; it is nearly always much longer than the other two stages combined. It is, indeed, a common observation that a longer time is required for the os uteri to dilate as large as a silver dollar than for all subsequent parts of the labor together. The first stage is usually longer in primipar-

FIG. 85.



Head at vulval opening distending perineum. (After PARVIN.) *a.* Caput succedaneum. *b.* Distended perineum. *c.* Anus. *d.* Coccyx, on line of circumference of distended area.

ous women, and still more so in primiparæ over thirty years of age. An os uteri that is soft, thick, and elastic dilates more readily than a hard, thin, rigid one. Premature rupture of the bag of waters greatly impedes dilatation.

Phenomena of the Second Stage.—Tremendous increase in the frequency, strength, duration, and expulsive or bearing-down character of the pains. Nevertheless they are more

contentedly borne, from (supposed) consciousness of progress on the part of the woman. The head of the child may now be felt descending into and beginning to protrude through the os uteri. It eventually slips through the os into the vagina, accompanied with renewed flow of some remaining liquor amnii. There may be a momentary pause in the suffering, and the woman may exclaim, "Something has come!"

The head now pressing upon sensitive nerves in the vagina elicits still more reflex motor power from the spinal cord, and the pains are still longer, stronger, more frequent, and expulsive. The corrugated scalp of the child, swollen and

FIG. 86.



Head about to pass the vulval opening. (After PARVIN.)

œdematous (constituting the *caput succedaneum*), successively approaches, touches, and begins to distend the vulva and perineum. The anus is dilated and everted, fecal matter is forced out, the perineum is stretched more and more, until its anterior border is almost as thin as paper, and at last, in a climax of suffering, the equator of the head slips through the second sphinctorial gateway (the os vaginæ), and the head is born. A minute of rest may follow, and then, with one or two more pains, the body of the child is expelled, and the second stage of labor is over. The duration of the second stage largely

depends upon the dilatability of the perineum. In a natural case, other things being equal, a soft, thick, elastic perineum, with abundant mucous discharge, and in a young and multiparous woman, will dilate sooner than when opposite conditions prevail.

Phenomena of the Third Stage.—By the time the child is fully expelled the placenta is often separated from the uterine wall and lying loose in the now contracted uterine cavity. The womb may be felt as a hard, irregularly globular ball above the pubes. There may be an interval of one-quarter or one-half of an hour's rest from pains, if the case be left entirely alone. Then, sooner or later, gentle pains again come on, the placenta is doubled vertically, the fetal surface of one half in apposition with that of the other, and the organ protruded endwise into the vagina, from whence it is, by other slight pains, finally expelled, together with some blood, remains of liquor amnii, membranes, etc. The womb now contracts into a distinctly globular, hard mass, no bigger than a cricket-ball, thus effectually closing the uterine blood-vessels and preventing hemorrhage, which last is further stopped by coagulation of blood in the mouths of the open blood-channels. Thus ends the third stage of labor.

The Vocal Outcry, Expression, etc.—These vary with the different stages of labor, and with the different periods of each stage, and even with different pains of the same period. At the very beginning of the first stage, the woman, being restive and perhaps walking about the room, stops for a few moments, frowns, places a hand upon the abdomen, or back, holds her breath in silence for a little time, and then, with a sigh of grief (the pain being over) goes on walking and talking as before. A little later, when the suffering becomes sufficient to cause an audible groan or outcry, it will be noticeable that the cry of the earlier pains, during commencing dilatation of the os uteri, is usually of a *high-pitched, treble note*—not unlike the plaintive whine of a setter-dog grieving for its absent master. So long as this kind of outcry continues, there is generally slow progress only. With later and more effective pains, especially toward the end of labor, the note of the outcry is of a *deep bass*, or guttural character. The best (*i. e.*, most effective) pains of all are those in which there is actually *no vocal sound* of any kind; the woman, with

closed eyes, compressed lips, and general contraction of the facial muscles, simply holds her breath (until nearly "blue in the face") and *strains*, with occasional brief jactitatorial expiratory and inspiratory gasps, until the pain is over. Then, having regained her voice, she declaims in hurried and voluble terms the intensity of her agony, the demand for help, the inability to bear it any longer, and the belief (perhaps) that she must die, etc.

During the earlier pains the hands are clenched and the arms forcibly flexed. Later on, and continuously until the birth, there is a disposition to grasp and pull any object within reach, usually bed-clothing, or the hand of an attendant; while steady pressure downward is made by the feet upon any firm support available for that purpose.

This disposition to grasp and pull with the hands while making pressure with the soles of the feet, is probably the rudimentary survival of habit, acquired by our sylvan ancestors ages ago (and still in vogue with some uncivilized peoples), when women were delivered in a squatting posture, the hands, meanwhile, grasping a sapling of the wood, or a stake driven in the ground, to steady them during the process.

THE DURATION OF LABOR.

The average duration of labor in natural cases is about ten hours. It may be over in one or two hours, or last twenty-four or longer without any bad consequences.

THE MANAGEMENT OF LABOR.

Preparatory Treatment.—In anticipation of approaching labor, precautions against constipation, by mild laxatives (castor oil, manna, rhubarb), may be necessary to prevent fecal accumulation in lower bowel. Moderate exercise, as far as practicable in the open air, and cheerful social surroundings, to mitigate despondency. Physical and mental excitement must be avoided. Ascertain whether urine be voided freely; if not, use male elastic catheter.

Preparation for Labor and Its Emergencies.—On being called to a labor case, the physician should attend *without delay*, and take with him *always* the following articles:

1. Compressed antiseptic tablets of bichloride of mercury.¹
2. A pair of obstetric forceps.
3. Fluid extract of ergot, fʒij.
4. Hypodermic syringe.
5. Hypodermic tablets of morphia, strychnia, and nitroglycerin.
6. A stethoscope.
7. Needles, needle-holder, and aseptic sutures.
8. Male elastic catheter.
9. A Davidson or fountain syringe.
10. Iodoform gauze.
11. Carbolic acid, ʒij.
12. Bottle of carbolized vaseline or mollin (5 per cent.).
13. Creolin, ʒij.
14. Rubber gloves.
15. Sulphuric ether, Oss. This last, being bulky, may be omitted, if it can be obtained within easy distance of the patient.

In addition to these things carried by the physician, the nurse or patient should be directed, before labor begins, to have ready also a bed-pan; an abdominal binder; a feeding cup; a pint of whiskey or brandy; two or three rolls of absorbent cotton; large and small safety-pins; two pieces of rubber sheeting, each one yard by two in size (for which, as a matter of economy, ordinary table oil-cloth may be substituted); antiseptic pads for the lochia; and larger bed-pads for labor; and a pair of obstetrical leggings, together with plenty of clean towels and hot and cold water.

The various "*maternity outfits*" now on the market, containing most of the aseptic textural materials, are convenient and inexpensive.

Many obstetricians recommend a much more elaborate and complicated array of materials, but if the practice of aseptic midwifery is ever to become universal, it is economy and simplicity that will make it so.

Aseptic Midwifery and Antiseptics.—At the present time no argument is necessary to accentuate the importance of a rigid aseptic *technique* in the management of labor and in obstetrical operations and procedures of every kind. The aseptic method has almost completely blotted out puerperal

¹ The tablets I use are those of Dr. C. M. Wilson, containing hydrarg. bichlorid., grs. 7.7, ammon. chlorid., grs. 7.3. Made by Wyeth & Bros.

fever from lying-in hospitals, where, in former years, many women died from that disease. While in private practice, with normal hygienic surroundings, the mortality from septic infection, without antiseptics, may by accidental good luck be comparatively small, it is exactly this small mortality from which every woman ought to expect and demand protection at the hands of her medical attendant. When prophylaxis is possible, the liability to disease and death cannot legitimately be left to chance and luck.

The real reason why aseptic midwifery has failed to receive in private practice the universal adoption which it deserves is not so much lack of belief in its efficacy, but lack of knowledge as to the method of procedure, difficulty in the selection of one method from many others, and patience in carrying out details of whatever plan may have been chosen. To facilitate and simplify the matter, the following directions may be of service.

Antiseptic Solutions.—Three antiseptics, now in common use, are *bichloride of mercury*, *creolin*, and *carbolic acid*. The stronger bichloride solution (1:1000) is made by adding about seven and a half grains of bichloride of mercury to one pint of boiled water; most conveniently and more exactly done by using the compressed tablets now on the market, each containing 7.7 grains of the bichloride, *exactly* sufficient to make the 1:1000 solution. Of course, 1:2000 or 1:3000, and 1:4000 solutions are made by adding the same amount of bichloride to 2, 3, or 4 pints of water respectively.

The strong solutions of *carbolic acid* (1:20, or 5 per cent.) can be made, approximately, by adding fʒvj (six small teaspoonfuls) of carbolic acid to one pint of water. This strong solution may be used to sterilize instruments, but a weaker preparation—ʒij to the pint of water—will be used for the vaginal or uterine douche.

Creolin does not dissolve in, but easily mixes with water to form a milky emulsion, the strength of which, for douching, should be from 1 to 2 per cent.—*about* fʒj (or a small teaspoonful) to one pint of water.

Of these three the bichloride is the best germicide, especially for cleansing the external parts. Creolin is safer for the internal douching. Carbolic acid, in strong solution, for instruments. In making either preparation, use first a little

hot water with the germicide, then add the required quantity later.

The aseptic management of normal labor aims to *prevent* infection. The prophylaxis consists in thorough disinfection of the *patient*, the *physician*, and the *instruments* and *appliances* employed. The simplest method is as follows: The *patient*, at the beginning of labor takes a tepid bath and is well scrubbed all over with soap and water. Then an enema of soap and water to empty the bowel; after the action of which, the external genitals, thighs, buttocks, and abdomen are carefully washed with a 1:2000 bichloride solution, special attention being given to overlook no fold or fissure of the surface. The vaginal douche, of 2 per cent. creolin solution, or the weak solution of bichloride of mercury formerly used before labor, has been abandoned, unless there be some already existing infection, when it may be used. The normal vaginal mucus is itself germicidal in some degree, as well as a useful lubricant, and should therefore be allowed to remain undisturbed. Moreover, washing out the vagina exposes the woman to some danger of infection from an unclean syringe. The *physician*, before making any examination or doing any operation, removes his coat, bares the arms to above the elbows, when the hands and arms are thoroughly scrubbed with soap, water, and a stiff nail-brush. Scrape the under surface of the nail-ends and the fissures surrounding the nails with some pointed instrument, not sharp enough to scratch, and having washed off all soap in some clean water, immerse the hands and lave the arms in a 1:2000 bichloride solution, and continue this last washing for ten minutes.

Some practitioners prefer to sterilize the hands by the potassium permanganate and oxalic acid method, which consists, after scrubbing with soap and water, in immersing the hands in a hot saturated solution of potassium permanganate and then in hot saturated solution of oxalic acid, the last being removed by a final immersion in sterilized water. Whatever solution be used for sterilizing the hands, it will be still advisable to put on rubber gloves, previously boiled, as an additional precaution, especially when the physician has been recently in contact with septic cases.

Forceps, and other metal *instruments*, should be sterilized by immersion in a 5 per cent. solution of carbolic acid; or

they may be wrapped in towels and boiled for ten minutes; special care to be given in cleansing joints, fissures, screws, and the nozzles of syringes. All soft textural fabrics—cotton, lint, etc.—to be sterilized in the bichloride (1 : 2000) solution and wrung out, before coming in contact with the genitals. *Sponges* should be abolished from the lying-in room; it is almost impossible to disinfect them.

It is needless to add that any *sutures* used (as in sewing up a perineum, etc.) must, of course, be *aseptic*, as in any other surgical operation; and *nurses* must be subjected to the same disinfection as the physician. Rubber cloths and oiled muslin or silk may be sterilized by rubbing them with the bichloride solution—1 : 2000.

The details of aseptic *technique*, during the several stages of labor, obstetrical operations, and the puerperium and its diseases, will be given in their appropriate places.

Preparation of the Woman's Bed.—Let it be anything rather than a feather bed—a firm mattress is best. Place it so as to be approachable on both sides. Cover it with a rubber sheet, and over this an ordinary bed-sheet. Fasten these two to the mattress with safety-pins; they are *not* to be removed after labor, but over them are placed a second rubber sheet and a second ordinary sheet, fastened in the same manner, which *are* to be removed after labor, leaving the first set clean and dry. The ordinary sheet of the second set should be turned down from above until the line of fold is below the woman's shoulders (the rubber sheets need only cover the lower two-thirds of the mattress), in order to facilitate its withdrawal from below, when labor is over. During labor, a pad about three inches thick, and two or three feet square, is placed upon the second sheet, beneath the woman's hips to receive all discharges. It may be made of folded sheets, or a soft blanket, or, still better, of oakum, jute, cotton, or some other absorbent material, packed in a cheese-cloth bag of proper size. All materials, blankets, and sheeting to be *thoroughly sterilized* before being used (see above). When labor is over, the upper rubber cloth (No. 2), with its soiled sheet and sodden pad, may be easily dragged off at the foot of the bed, leaving the patient resting upon the dry sheet (No. 1) first placed over the rubber cloth (No. 1) fastened to the mattress.

Instead of the absorbent pad, the caoutchouc pad, devised by H. A. Kelly,¹ may be used. It not only protects the sheets, but conducts discharges over the side of the bed into a vessel on the floor.

Arrangement of the Night-dress.—Its skirt should be rolled up to the level of the armpits or a little lower, so as to be out of the way of vaginal discharges, while a thin petticoat or light flannel skirt covers the parts below the waist. When labor is over the soiled skirt may be readily removed over the feet, without lifting the patient, and the dry night-gown then pulled down from above. In place of the skirt a pair of obstetric leggings may encase the lower limbs as far as the thighs and be fastened to the night-gown above the waist. They can be readily removed from below when labor is over.

Examination of the Patient.—1. Verbal examination, in as gentle and pleasant a manner as possible, into the child-bearing history of the patient, as to the number (if any) of previous labors; their character, duration, and complications (especially as to flooding after delivery). Did the children survive? Symptoms during present *pregnancy*, if not already ascertained. Has it reached full term? Present symptoms of labor? Pains, when did they begin? Their frequency, severity, character, and duration? Character of the flow? Has the bag of waters broken?

2. Abdominal examination, to ascertain, by palpation and inspection, the size and shape of the gravid uterus, the presentation and position of the child, and the existence or otherwise of multiple pregnancy, complicating tumors, hydramnios, etc. On *inspection*, the practised eye readily appreciates any marked departure from the usual symmetrical form and ordinary size of the normal gravid uterus; also decided malformations of the woman's shape, indicating pelvic deformity. The greater width of the abdomen, in a transverse or oblique direction, visibly suggests shoulder presentation. Suspicious aroused by inspection to be confirmed, or otherwise, by *palpation*.

The *methods of palpation* here given relate only to normal cases of head presentation.¹ The woman lies upon her back, the lower limbs straight out, and the feet slightly separated or partially flexed with the heels together; if *completely* flexed

¹ Palpation in other cases will be considered in relation to the *diagnosis* of the several presentations and abnormal complications.

the thighs come in contact with the enlarged abdomen and obstruct the examination. The bladder and rectum must be empty and the abdomen bare, except perhaps one layer of some thin fabric. The manipulations to be practised *only* in the absence of uterine contractions—between the pains.

FIG. 87.



Flexion of the head, making the *occiput descend* and the *forehead rise*. (From DAVIS, after LEOPOLD.)

The educated hands or fingers will recognize the following characteristics of the several parts of the child :

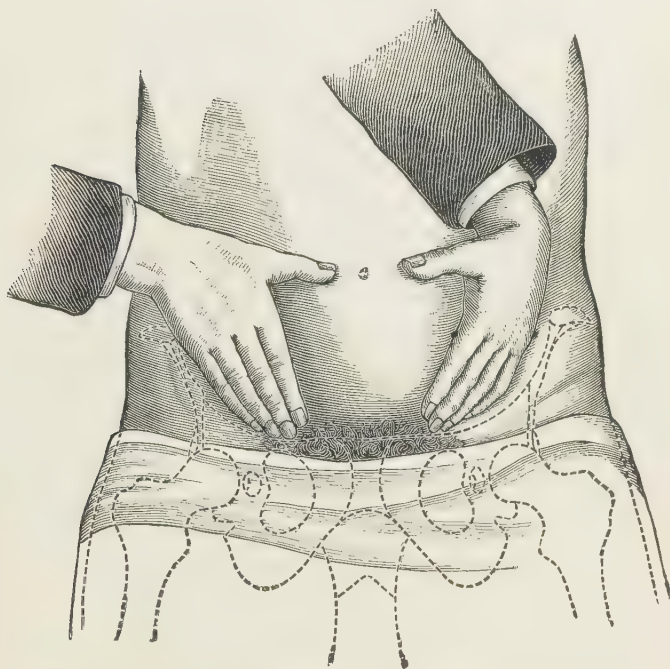
(a) The *head* : it feels *hard* and *globular*—there is nothing else like it—if not engaged in the pelvis it may be made to swing or move from side to side between the hands—a real *ballotement*,

(b) The *breech*: it feels *soft* and *irregular*—quite different from the cranium:

(c) The *back*: it feels like a *firm, resisting, plane* surface, or one side of a long cylinder.

(d) The *abdomen*: the abdominal aspect of the child is covered by the extremities and liquor amnii; hence it feels *soft*,

FIG. 88.



Palpating head in lower part of uterus, but not yet in pelvic cavity below brim.

elastic, and unresisting, with irregular projections (the upper and lower limbs), which may move actively or be moved by the examiner—very different from the firm, resisting plane of the child's back.

(e) The *forehead and occiput*: the head being usually *flexed*, the occiput will be tilted down toward the pelvis and its poste-

rior projection reduced almost to a continuation of the plane surface of the back and nape of the neck; hence the examiner's fingers reach it with difficulty or fail to touch it at all; while the *forehead*, being *tilted upward and forward* toward the anterior plane of the child, becomes *more prominent*, and is *easily recognized*—it feels *harder, larger, and higher* above the brim than the occiput. (See Fig. 87, page 244.)

FIG. 89.



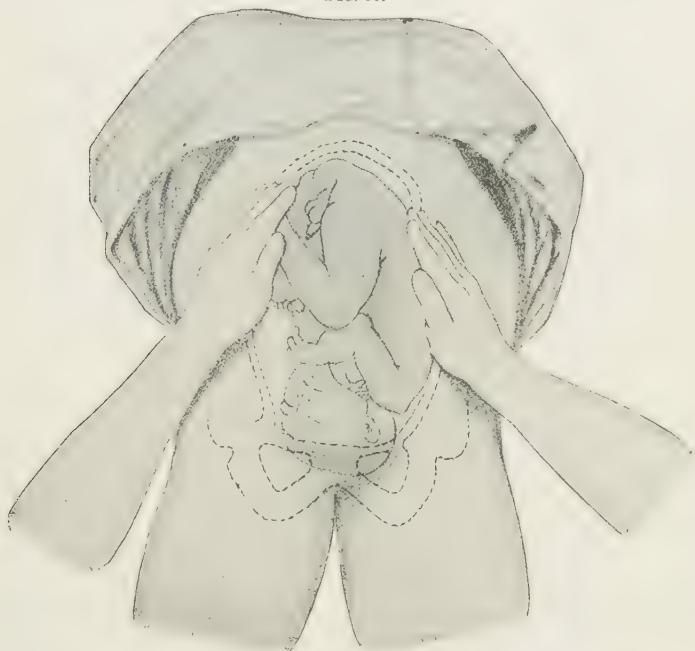
Palpating breech. (After DAVIS.)

(f) The globe of the presenting head may be *above the pelvic brim*, or may have *descended*, more or less, into the *pelvic cavity*. In the former case the examiner's fingers dip below the brim, and find the pelvic excavation empty; in the latter case, descent of the head into the brim fills the space, and the fingers *cannot enter* the inlet of the excavation. If, *before*

labor, or during *its beginning*, the presenting part descend into the excavation, it is a *head* presentation : no other presentation will do this.

In palpating the abdomen experience has demonstrated the following series of successive manipulations to be advisable :

FIG. 90.

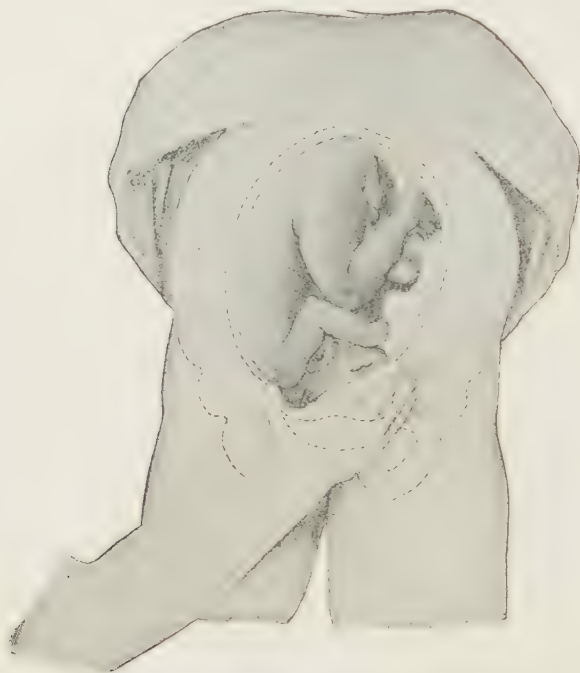


Palpating plane of back and movable small parts. (From DAVIS, after LEOPOLD.)

First.—The examiner, being at the side of the patient and facing her, places the palms of both hands *across* the abdomen above the umbilicus—the finger-tips of one hand touching those of the other—then glides the hands upward with gentle pressure until their cubital borders sink in above the fundus uteri, thus defining the height of the latter—its nearness to

the ensiform cartilage—and the probable duration of pregnancy. The hands also recognize the head or breech (see Fig. 89) occupying the fundus; or their absence, indicating a transverse or oblique presentation. This examination may also be done with *one* hand. (See Fig. 91.)

FIG. 91.



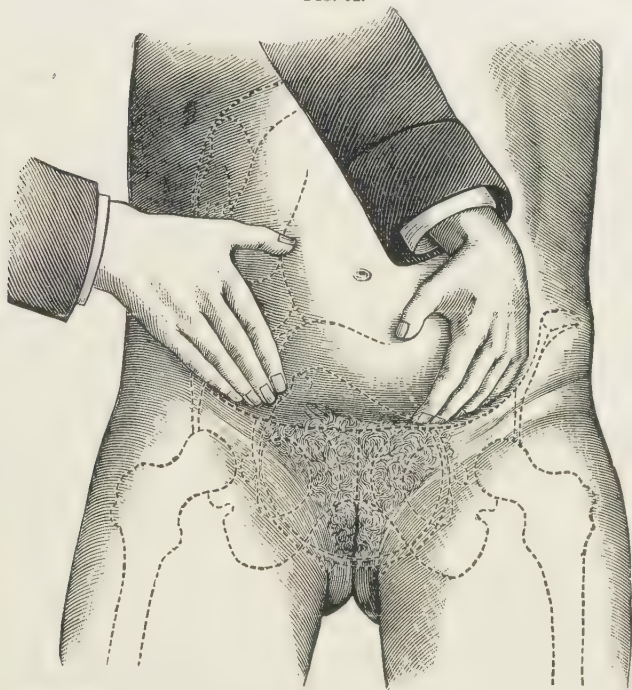
Palpating hard globular head with one hand. (From DAVIS, after LEOPOLD.)

Second.—Both hands, being used as in the last manipulation, now separate from each other, and the palms pass to the *sides* of the uterus, where *one* feels the smooth resisting plane of the child's back, the *other* the irregular projections of the extremities over the child's abdomen. (See Fig. 90.)

Third.—One hand only is used; it is placed *across* the lowest part of the middle of the abdomen just above the pubes,

its ulnar border being toward the mons veneris; the thumb on one side and finger-tips on the other then attempt to grasp boldly the presenting head, its hard consistency and defined globular shape being easily distinguished from the ill-defined outline and softness of a breech case. (See Fig. 91, p. 248.)

FIG. 92.



Palpation with head in pelvic cavity; fingers toward the occiput enter deeper than those toward forehead. (PÄRVIN.)

The hand may be placed higher or lower, according as the head has or has not descended into the pelvic excavation. In either case the *forehead* will be more prominent and more easily recognized than the *occiput*, as already explained.

Fourth.—Instead of the *third* manipulation just previously described, the following method may be used:

The examiner, standing with his back toward the patient's face, places his hands on the abdomen, about four inches apart, so that the finger-tips touch the upper margin of the pubic rami, while the thumbs point toward each other at about the level of the umbilicus. Now let the finger-ends push before them a shallow fold of the abdominal wall down between the presenting head and posterior aspect of the pubic bones near the ilio-pectineal eminence. The finger-ends thus actually enter the pelvic brim *below* the head, if the latter have *not* descended into the excavation; or, if the head *have* so descended, the fingers cannot enter, but recognize the head obstructing their passage through the brim, the more prominent *frontal* region being recognizable as offering *more* obstruction to the hand on *that* side of the pelvis than is offered by the pole of the occiput on the *other* side, where the finger-ends can penetrate a little deeper (see Fig. 87, p. 244, and Fig. 92, p. 249). If the abdomen sag forward, it may with the palms of the hands be lifted up a little out of the way, and thus facilitate the entrance of the fingers below; and if the abdominal wall be tense, this may be partially relieved by the lower limbs being slightly flexed, with the knees apart and heels together.

The *presentation* of a head having been demonstrated by these manipulations, the *position* of the occiput will be also known by observing where the *back* is, and whether the prominent *frontal* region be directed *anteriorly* or *posteriorly*, to the *right* or to the *left*. With the abdominal examination may be included external pelvimetry (which see). Every pregnant woman should have her pelvis measured early in gestation. If previously omitted, it should be done later, either before or during labor.

3. Vaginal examination. To the young practitioner, who may experience some embarrassment with his first vaginal examination, the following suggestions may be of service:

In labor cases it is *not* necessary to obtain *verbal* consent of the patient before instituting the examination. Proceed (the woman being in bed) without hesitation, as if consent had already been obtained. Having been sent for to attend her is a sufficient guarantee of this. If anything is to be *said* on the subject, some such remark as "Well, we'll see how you are getting on"—suiting the action to the word—will be amply sufficient; or a simple inquiry as to the convenience of

soap, water, and towel may be enough to introduce the subject and indicate one's purpose. The less said the better. Proceed, *without hesitation*, just as in feeling the pulse. Should the woman cry, demur, and declare she cannot submit to the examination, proceed just the same, meanwhile addressing to her any kind word of encouragement that may serve to lessen fear or embarrassment. Nothing but *physical* resistance on the part of the woman should induce the physician to give up the examination. This will seldom occur; when it does, there is nothing to do but withdraw from the case, or the announcement of this *intention* will generally remedy the difficulty.

Should the patient be dressed and sitting up, she must be requested to go to her room and lie down in order that the examination may be made. Instruct the nurse to place her near the edge of the right side of the bed, that the right hand may be conveniently used. The lower limbs are covered with sterile dressings secured with safety pins (or with leggings), so that the vulva and perineum are left exposed. Under the nates and perineum is placed a moist towel or pad freshly wrung out of a bichloride solution. It is assumed, of course, that the woman has already been made aseptically clean, as explained on page 241. The physician is to be notified when she is ready.

Position of the Woman.—On the back, with the knees flexed, is the obstetric position most common in the United States. Some practitioners prefer the English position, the woman lying on the left side near the right edge of the bed, with her knees drawn up.

Introduction of the Fingers.—After proper disinfection (see pp. 241 and 242), anoint the right index finger with carbolyzed vaseline (or mollin), 5 per cent., or some other aseptic lubricant.

Recently, to secure a more rigid aseptic technique, the vaginal examination is made under *inspection*. The parts are completely exposed to view, the labia are separated by external pressure with the thumb and finger of one hand, while the examining finger of the other hand, guided by sight alone, is passed directly into the vagina without so much as touching the external surface of the vulva, on which germs are likely to exist. The woman's lower limbs being flexed,

the examining hand passes directly between them to the vulva—always below, never *over*, the thigh. The finger is directed rather toward the posterior than anterior commissure; it will reach higher in the vagina if the remaining fingers are not doubled into the palm, but stretched out over the perineum so that the posterior commissure fits into the deepest part of the space between the index and middle fingers. The perineum may thus be pushed in, or lifted somewhat upward and inward, when there is any difficulty in reaching the os uteri. In case the index finger will then not reach far enough, it and the middle finger may both be introduced together.

Care must be taken not to invert any hair, but to prevent this, and for aseptic purposes, all hair upon the labia and mons veneris should have been previously clipped short. Shaving the external parts, as in hospital practice, cannot always be carried out with private patients.

Purposes of Vaginal Examination.—By this examination we learn :

1. The condition of the vagina and vaginal orifice as regards their patency and freedom from obstruction to the passage of the child; also their temperature, sensibility (freedom from tenderness), and moisture.

2. Corroboration of the existence of pregnancy if not previously ascertained by physical proof.

3. Condition of the os uteri—its *degree of dilatation*, thickness, consistency, and elasticity.

4. If labor have actually begun.

5. To what stage it has progressed.

6. Whether the bag of waters has ruptured.

7. What the presentation is.

8. The condition of the pelvis, whether normal or deformed.

9. The state of bladder and rectum as to distention with their respective contents.

When accustomed, by practice, to the examination of *normal* vaginae, pelves, etc., the existence of any *abnormality* is readily appreciated by the finger without any particular attention being given to each of the details just enumerated. In commencing practice, much more care is necessary to avoid overlooking existing departures from the natural state.

In learning the degree to which the os uteri is dilated, it is the size of the *circular rim* (or lips) of the *external os* that we wish to ascertain. Without care the finger may be passed through a *small os uteri* and swept round a considerable surface of the presenting part or amniotic sac, thus conveying an impression that the os is dilated when it is not. Finding a small, hard, easily movable uterus, *per vaginam*, at once negatives the existence of advanced pregnancy, unless it should happen to be an extra-uterine case. A pregnant woman may imagine herself in labor when she is not, owing to the occurrence of "*false pains*." These, on vaginal examination, are found to be inefficient as dilators, hence they produce no dilatation of the os and cervix and no tension or prominence of the bag of waters. The premonitory symptoms of labor are absent. There is no "show" or but very little mucous discharge. The suffering is almost entirely in the abdomen; not in the back, as in *true pains*. False pains are irregular, and short, and do not increase in strength, duration, and frequency, as real labor pains do. In from twelve to twenty-four hours they stop altogether, without any definable cause. Furthermore, false pains occur before full term, without any apparent cause of uterine contractions.

Some women present a remarkable monthly periodicity, others at intervals of six weeks, in the recurrence of false pains. They seem to be exaggerations of those "*intermittent contractions*" of the uterus considered as signs of pregnancy, or the insensible contractions of the early months, become perceptible later on, at stated periods. Hence they have been called "*pregnancy pains*." Quinine has been successfully used as a test between true and false pains. One or two five-grain doses, with an interval of two hours, will increase and accelerate *true* labor pains, but have no effect on *false* ones (Schatz). False pains often occur from intestinal sluggishness, and can be relieved by laxatives and opiates—morphine or codeine.

Returning now to consider the uses of the vaginal examination, the diagnosis of a head presentation may be made out before the os is dilated. The hard, smooth globe of the head may be recognized through the wall of the uterine cervix. There is nothing else like it. Generally the os will admit a finger, when the cranium, if not too high up, may be readily

felt, covered by the membranes. It is not always easy to ascertain whether the membranes have ruptured. Statements of woman or nurse are not reliable. If there be a layer of liquor amnii between the head and membranes, the space and fluid may be readily recognized by gentle pressure with finger *between the pains*. Not so when the membranes closely embrace the head. Then feeling the child's hair, and corrugation of the scalp during a pain, show the bag has broken. The membranes, on the contrary, become smooth and tense during a pain, possibly wrinkled a little in the intervals.

Opinion as to Time of Delivery.—After one examination only, no opinion as to the duration of labor can be confidently formed; certainly none should be expressed. Having felt the head, we may say "everything is right," and encourage the woman not to despond. After a second examination in twenty or thirty minutes, we may *form*, but should not express, an approximate idea as to time of delivery, by degree (if any) of progressive dilatation that may have taken place. These statements refer mostly to the first stage of labor, especially in primiparæ. When the os uteri has dilated to the size of a silver dollar, the labor may be said (usually) to be about half over. When the head has passed through the os uteri into the vagina and is beginning to distend the perineum, of course an opinion as to speedy delivery is *generally* justifiable.

Is It Necessary to Keep the Patient in Bed during the First Stage?—No. Let her sit, walk, or change her position as she desires, until the bag of waters is about to break, when recumbency is desirable to prevent washing down of the umbilical cord by the gush of liquor amnii, and for other reasons.

Rupture of the Bag of Waters.—Just *before* rupture the woman should be told what is going to happen, to prevent alarm, especially if she be a primipara, and an extra cloth or piece of blanket may be placed under her, to soak up the bulk of the flow. Just *after* rupture a vaginal examination should be made to ascertain more surely the presentation, and that no change has taken place in it, and the sutures and fontanelles may now be felt, and the "position"¹ of the head made out. The extra cloth may be removed at once.

¹ "Position," in obstetrics, means the positional relation existing between a given point on the presenting part and certain fixed points on the pelvis. There are several "positions" to each "presentation," as will be explained hereafter.

Number of Attendants.—It is not desirable for the physician to remain in the lying-in room during the first stage of labor. After having seen that every preparation has been made, and having expressed a willingness to be called at any time the woman may desire, let him retire to some other apartment. One nurse is necessary, and an additional attendant or relative not objectionable, but no others. The husband may be present or not, as the wife may prefer.

Precautions during Early Stage.—If the rectum be loaded, administer an enema of soap and water to empty it. See that the bladder empties itself. If not, use a catheter. Protect the woman from a glare of light, whether by day or night. Keep the temperature of the room at 65° or 70° F., if practicable. Instruct the patient *not* to strain or bear down during first stage; it does no good, and tires her.

Pinching of the Anterior Lip of the Os Uteri.—As the head passes out of the uterus into the vagina the lower margin of the os uteri slips up out of reach of the finger, but sometimes the anterior lip of the os gets pinched between the child's head and pubic bones so that it cannot slip up. It may then become greatly swollen, congested, and œdematous.

Treatment.—Push it up with the ends of two fingers, between the pains, and hold it there till the next pain forces the head below it.

Cramp in the Thighs.—Painful cramps along the inner side of the thighs may occur from pressure of the head—probably upon the obturator nerve, or upon the sacral nerves—while passing through the pelvic canal.

Treatment.—Empty the bowel by an enema; use manual friction upon the painful part; and hasten delivery by forceps, if necessary.

The Perineum will usually require attention to prevent rupture. There is no fear of laceration so long as the anterior border of it maintains any considerable thickness and is not fully on the stretch during the pains. Hence, no “support” is necessary, and nothing is required but to watch the progress of the head (now easily touched inside the vulva), and ascertain when the perineum *does* become thin and tightly drawn out over the advancing head, and when there *is* danger of laceration, especially if the labor progress *rapidly*.

Treatment.—Ask the woman to refrain from bearing down,

from holding her breath, pulling with her hands, pushing with her feet and knees, etc. If unable to control her straining, anesthetize her. The *methods* of manipulation to prevent laceration of the perineum are almost too numerous and varied to mention, but the *principles* involved (which it is most important to understand) are few, and always the same, viz.: 1. Give the perineum time to stretch, by retarding expulsion of the head—especially by retarding “*extension*.” 2. Guide the head so that it may occupy as little space as possible, by keeping the plane of its smallest circumference parallel with the plane of the perineal ring through which it must pass; or, what is the same thing, keep the long diameter of the head at right angles to the plane of the perineal girdle; the central point of the occiput must lead—go first—and keep in the centre of the ring. 3. Relax the perineum as much as possible by gathering in tether from surrounding tissues—“give it rope” from the outside.

The manipulation may be accomplished either with the woman upon her left *side*, or in the *dorsal* position, provided the lower limbs be not forcibly flexed or widely separated, and for which there is no necessity. Unreserved *ocular inspection* of the parts is absolutely required. Note especially that rupture usually occurs *at the moment* or *during the few moments of the last one or two pains*, just as the head is being extruded. Normally the head is delivered by “*extension*” (see Mechanism of Labor, Chap. XIV.), the occiput rising over the mons veneris, while forehead, face, and chin successively emerge at the perineal margin. Hence, to retard expulsion (which may be done *directly* by pressure upon the central occiput), we must *retard extension* by pressure transmitted through the perineum upon the frontal bone (the forehead), which *indirectly* retards expulsion; the place on which this forehead pressure is made is *between the anus and coccyx*. Extension *must* occur eventually or the child could not well be born; our purpose is to *delay*, not prevent it. When the perineum has had time to stretch, we permit extension and consequent expulsion to take place.

In the manipulation to carry out these purposes, both hands are simultaneously used (the woman being either upon her side or back—preferably the former), as follows: The right hand is so placed that its fingers rest upon the posterior part

of the left labium pudendi, and the thumb upon the right labium, the web of skin between the thumb and index finger being about in line with the perineal margin. (See Fig. 93.) At the same time the left hand, passed down in front over the pubes, makes *direct* pressure upon the centre of the protruding occiput. (This is *not* shown in Fig. 93.) During the pains the fingers of the left hand make direct pressure upon the advancing occiput in line with the long diameter of the head, to stop it from coming out, while the fingers and thumb of the right hand gather in perineal tissues from the sides,

FIG. 93.



Mode of effecting relaxation of perineum. (After PLAYFAIR).

thus relaxing central tension, while at the same time they—aided by the palm and ulnar border of the hand—transmit a deeper pressure through the perineum upon the forehead, to *retard extension*; meanwhile the manipulation unavoidably pushes the entire head up toward the pubes, thus utilizing any spare space left between the pubic arch and back of the child's neck. An almost similar method of regulating the birth of the head, and the relative position of the patient and

physician during the proceeding are well shown in Fig. 94, from Jewett's work. During these proceedings the parts

FIG. 94.



Regulating birth of head. (JEWETT.)

should be swabbed occasionally with a hot solution of bichloride on a pledget of aseptic cotton, and the hands of the operator washed in a similar fluid. It is well also to interpose a pledget of cotton between the fingers and the occiput when

making pressure. When it is finally deemed advisable to allow the head to escape, let this occur, if possible, *between* the pains.

In Jellett's method, represented in Fig. 95, "the heel of the right hand pushes the head forward by pressure applied between the anus and the coccyx, and the fingers of the left hand endeavor to *draw* the head forward."

FIG. 95.



The indirect method of preserving the perineum. (JELLETT.)

Other methods of manipulation—the objects and principles of which will be the same as already described—are the following: (1) Place the thumb upon the advancing occiput and two fingers (of the same hand) *in the rectum*, by which the forehead is kept from extension and the perineum relaxed by lifting it up toward pubes during the pains (Goodell); (2) standing behind the woman (while she lies upon her left side) apply two fingers of the right hand to the occiput and pass the thumb into the rectum, and thus hold back the head during pains (Fasbender). To get out the head *between the pains*, upward and forward pressure may be made with the thumb or fingers in the rectum, upon the face or chin; or pressure

upon the outside, behind the anus, close to the coccyx, may be guided, and admitted to pass at will, by the action of the instrument.

The rectal manipulations—at best inconsistent with rigid antisepsis—require extreme cleanliness.

In cases where, despite these manipulations, rupture appears inevitable, the operation of *episiotomy* may be performed. The resisting ring of tissue being recognized by the finger just inside the perineal margin, a probe-pointed curved bistoury, or tenotomy knife, is passed in flatwise between the head and vaginal wall, at a point about one-third of the distance from the posterior commissure to the clitoris; then the edge of the knife is turned outward toward the vaginal wall, and an incision made about half to one inch long and one-fourth of an inch deep. The skin may or may not be cut by the incision.

The *direction* of the cut (when the parts, of course, are distended) should be “up and down”—that is parallel with the long axis of the woman’s body. It may be done on both sides. After labor the wounds are stitched up with fine aseptic catgut. It is not often resorted to, and its alleged extraordinary good results are not always realized.

Should the perineum escape rupture during delivery of the head, it may yet be torn during the passage of the shoulders. This may be prevented by lifting the head and neck up toward the mons veneris, so that one shoulder goes back behind the symphysis pubis while the other escapes at the coccyx. This enables one shoulder to be born at a time, and produces less strain upon the perineum than when both are pulled out together, and with rude haste, which must be avoided.

Birth of the Head.—When the head is expelled, feel with the finger if the umbilical cord encircle the child’s neck. If so, draw down the cord from whichever direction it will most freely come, and pass the loop of it thus formed over the head. See that nothing impedes the further free motion of the head. Keep one hand on the womb and by gentle pressure follow down its decreasing size, so as to assist its contraction and prevent hemorrhage. Support the head in the other hand, and as another pain or two expels the shoulders and body, gently lift it in a direction continuous with the axis of the pelvic curve *i. e.*, *slightly* upward. No traction is necessary generally; and though the child’s face begin to get

bluish, there is no necessity for haste, no fear of suffocation, even though delayed several minutes, which it rarely will be, before complete expulsion. *After expulsion of the child*, cleanse its nostrils and mouth from mucus, etc., and see that it breathes. If it do not, slap the buttocks (not roughly), rub the spine, dash a little water in the face or on the chest, which will generally suffice in an ordinary case. When respiration is established, let the infant rest on the bed between the thighs of the mother, preferably on its right side or back, avoiding contact with discharges, while the navel string is attended to. No haste is necessary in tying and cutting the cord, unless relaxation of the uterus, flooding, or some other condition of the mother, require immediate attention from the physician.

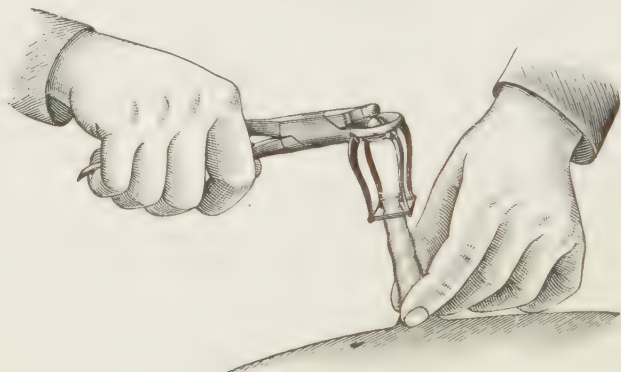
In the absence of any such emergency, it is best to wait until pulsation in the cord has ceased or become almost imperceptible. By this little delay, while the child's pulmonary circulation is being thoroughly established by chest expansion and the mechanical vibration of lung capillaries produced by its cries, the infant obtains from the foetal side of the placenta, through the untied cord, several drams of blood that properly belong to it, and of which it would be robbed if the cord were tied at once.

Management of the Navel String.—Ligatures—preferably of strong aseptic silk (but narrow tape or any other suitable material, properly sterilized, will answer) should have been previously prepared. When the child has cried—thus inflating its lungs with air, and starting complete pulmonary circulation—the quantity of blood thus drawn from its general circulation being renewed from the foetal half of the placenta through the thus-far unobstructed umbilicus vein—the cord should be cut before ligation about an inch distant from the abdomen, its root being pinched with a thumb and finger close to the umbilicus to prevent bleeding, while a finger and thumb of the other hand squeeze out of its distal extremity by a sort of milking process (“stripping”) any excess of Wharton's jelly. The stump of the cord (sometimes thick and voluminous) thus becomes flaccid and ribbon-like, when the ligature is put on near its distal end, and tied tightly, but not so tight as to wound the bloodvessels. Should the end bleed, put on a second ligature just above the first one and tie it more strongly. A. C. Kellogg of Wisconsin has devised an instrument for

passing over the end of the funis a stretched rubber ring (see Fig. 96), which, when the instrument is removed, contracts down on a cord, like a ligature, to prevent hemorrhage. It is effective enough, but not better than simple ligation, for which no instrument is necessary.

To prevent injuring the child while cutting the cord with ordinary scissors—which might happen from the motions of its lower limbs during the operation—place the back of the left hand flat upon the abdomen and let the cord project between the palmar surface of two fingers, while the scissors are applied flat-wise with the right hand.

FIG. 96.



Elastic funis ring applicator.

There is no necessity for putting a ligature upon the placental end of the cord, unless twins be suspected, when it should be done.

The custom of leaving the stump of the funis one or two inches long was adopted to prevent ignorant persons from including the (not uncommon) protruding gut of an umbilical hernia in the ligature. When certain that no such hernia exists, the stump might just as well be cut off half an inch from the skin; such a practice has been recently recommended in the interest of asepsis—it leaves less dead tissues to separate. Still more recently, the cord has been cut close to the abdomen

and its vessels ligated separately as in a surgical operation—a complicated process quite uncalled for and not to be recommended.

After simple ligation, as first above-mentioned, it is of prime importance to prevent infection of the stump, by dressing it every day with a fresh piece of dry aseptic (borated, or salicylated) cotton, the stump itself, and navel, having been first dusted over with boracic acid.

The cord having been attended to, examine the child for deformities or malformations; give it to the nurse, who holds a warm flannel or blanket for its reception; and caution her to let no strong light glare in its face, and to get no soap in its eyes. Under circumstances and places in which the child is exposed to the infection of ophthalmia neonatorum, the eyelids should be carefully washed externally with clean warm water, and from the end of a glass rod one drop of a nitrate of silver solution (strength 1:50) should be dropped on the cornea of each eye immediately after birth.

Delivery of the Placenta.—The child having been disposed of, place a hand upon the fundus uteri. If it be found symmetrical in shape, hard, and as small in size as a large cricket ball, the placenta is probably resting loose in the vagina. If it be larger than this, and not so symmetrically globular in shape, the placenta is most likely still in the womb. In this latter case manipulate the fundus and make pressure upon it to excite contraction, meanwhile asking the woman to bear down when she feels the pain begin. Again, having noted the *position* of the uterus, it may be observed that when the womb expels the placenta the fundus will *rise* about two inches toward the umbilicus, as if the organ pushed itself up and away from the discharged placenta. Should the placenta not be expelled in fifteen or twenty minutes spontaneously, the fundus uteri may be grasped firmly with the hand, and the placenta literally squeezed from the uterus into the vagina, after the method of Crédé. (See Fig. 97, page 264.)

To be successful in this procedure, the uterus must be grasped bodily by the thumb and fingers so that the fundus rests in the palm, and firm pressure made only *during uterine contraction*—at the *height* of a labor pain. *Both* hands may be used, the eight fingers going behind the uterus, the thumbs in front. Hold the womb continuously, but less firmly between

the pains, and resume strong pressure as the pain returns, and so on for six or seven pains if necessary—the *direction* of pressure being downward and backward in line with axis of

FIG. 97.

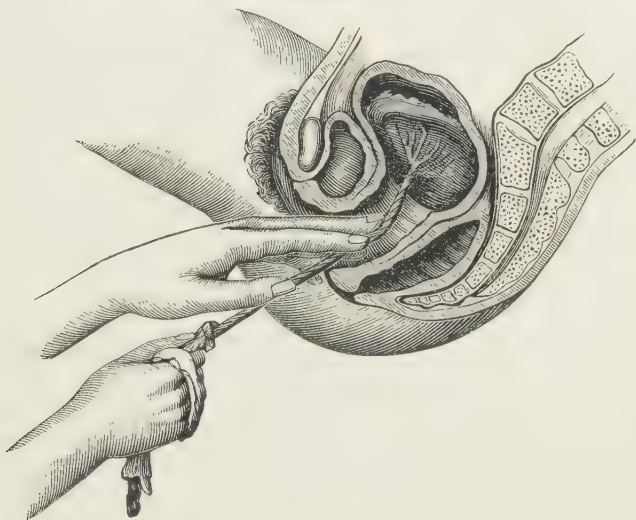


Credé's expression of the placenta. (REFERS, from a photograph by H. F. J. After JEWETT.)

uterus. If the pains are tardy in their recurrence, press the finger-ends on the abdominal wall and make rotary friction

over the uterus to provoke contraction. When the placenta has passed entirely through the os uteri into the vagina, it is easily extracted by hooking into it one or two fingers and making traction. When it is only half-way through the os, the index and middle fingers are passed up to it, following the cord for a guide, and the organ being grasped between the finger-ends, it is made to bulge completely through the os by directing traction *backward* toward the sacrum, the other hand

FIG. 98.



Faulty method of removing placenta by traction on the cord. (After PLAYFAIR.)

compressing the fundus, and the woman being told to bear down. Never, under any circumstances, make traction on the cord. It tends to pull the placenta flatwise (like a button in a button-hole), thus obstructing its egress (see Fig. 98), and might, if the placenta were still adherent, invert the womb. When undisturbed by traction on the cord, the placenta will be folded vertically, in line with the long axis of the womb, as shown in Fig. 99, page 266.

In normal cases it may be possible to deliver the secundines by external pressure alone, and without using a finger in the vagina, and in the line of rigid antisepsis this is advisable. It is not necessary to hurry the delivery of the placenta immediately after the infant's birth; an interval of fifteen or twenty minutes gives time for coagula to form in the mouths of the uterine bloodvessels, and thus contributes to prevent

FIG. 99.



Normal doubling of placenta. (After DUNCAN.)

hemorrhage. The practice of giving *ergot* to expedite expulsion of the placenta has been abandoned. It may, however, be given, and with advantage, to secure firm uterine contraction, after the placenta is expelled; the dose being \mathfrak{zss} to \mathfrak{zj} of the fluid extract.

As soon as the organ has passed the vulvar orifice, hold it there, close up, and with both hands twist it round and round, always in one direction, and the membranes will thus be twisted

into a sort of rope, which gradually gets longer and narrower until terminating in a mere string, which finally slips from the vagina, and delivery is complete. If this twisting device be not adopted, a part of the membrane is likely to remain, and becoming entangled with clots of blood, cause after-pains, and come away fetid, days afterward, not without alarm to the patient.

After delivery the placenta should be inspected to see that no part has been torn off and left behind, and then deposited in the vessel held by the nurse for its reception.

Firm *contraction* and *retraction* ¹ of the uterus having been secured, the third stage of labor is over. It remains to make the woman aseptically clean and comfortable. The soiled sheets and pads are removed; the nurse cleanses the skin from blood-stains with a bichloride solution, dries it with a clean towel; puts under the hips a clean, dry draw-sheet, and the patient is now ready for the binder and vulvar dressing.

A mild bichloride solution (1 : 4000) should be used to wash out the *vagina* before the dry dressings are applied. It is *not* necessary or desirable to wash out the *uterus* in a normal case.

The Binder.—The binder is an abdominal bandage designed to support the stretched walls of the abdomen and compress the uterus so as to prevent its relaxation and consequent hemorrhage. It gives the woman comfort, and prevents syncope. It scarcely improves her figure as was once supposed.

It may be made of strong unbleached cotton or jean, and must be wide enough to reach from *below the projecting trochanters* (otherwise it will slip up) nearly to the ensiform cartilage, and long enough to go once around the body and overlap enough for fastening with strong "safety-pins." Let there be no creases under the back. Pin it, from above downward, where the ends meet in front of the abdomen, as tight as may be comfortable. Some prefer to pin it from below upward.

Another method of applying the binder is to pin it at first loosely with ordinary pins, put in transversely half an inch apart along the median line, and afterward tighten it around the narrower part of the waist by gathering in a fold on each

¹ The difference between "*contraction*" and "*retraction*" is as follows: *Contraction* is an active but transient muscular action lasting only a minute or so; *retraction* is the permanent maintenance of the firmness produced by *contraction*, after the *contraction* itself has ceased.

side of the body, these folds being retained in place by safety-pins longitudinally applied. (See Fig. 100.)

An aseptic pad (preferably made of sterilized jute or absorbent cotton, wrapped in cheese-cloth), two inches thick, four inches wide, and ten inches long, is applied to the labia to receive the lochial discharge. In the absence of such a pad a perfectly clean, aseptic napkin may be used. They are kept in place by being fastened to the binder above and below. The pads are to be removed and burned as often as may be necessary from the amount of discharge.

FIG. 100.



The abdominal binder. (JEWETT.)

A more perfect aseptic method—the so-called “occlusion dressing” is the following: A piece of lint, 12 x 8 inches in size is soaked in and wrung out of a 1 : 2000 bichloride solution. It is folded in the middle lengthwise, and then folded again, which makes it three inches wide and four layers thick. This is applied directly to the vulva. Over it is placed a piece of aseptically clean oiled silk or muslin, four inches wide and nine inches long. Again over this comes a large pad of

cotton-batting, the whole being kept in place by a square half-yard of muslin, folded like a cravat, each end of which is fastened to the abdominal binder. The dressing is changed every six hours, and the external genitals are laved with bichloride solution before a new one is put on.

Before any dressing is applied, the perineum should be examined, *in all cases by ocular inspection*, for laceration. If any be found it should at once be repaired by sutures of aseptic catgut. Catgut sutures require no removal; they may be left to digest in the tissues and come away of themselves. The sutures may be *passed* before the placenta is delivered, and *tied* after its delivery. The parts are less sensitive immediately after labor, and the anæsthesia produced during delivery still remains.

Attentions to Newborn Child.—The nurse anoints it with olive oil, and then washes it with mild soap and water, to remove the *vernix caseosa*—an accumulation of whitish, sebaceous matter—from the skin, especially plentiful about folds and creases. It is most abundant in over-long pregnancy.

Dressing the Stump of the Cord.—It is an old *custom*, still prevailing in some rural districts, to draw the stump of the funis through a hole made in the centre of a bit of greased rag, then fold the borders of the rag over, and after laying it upon the abdomen with the end downward, place one or two belly-bands round the child to keep it in place. It is an abominable practice. If there be no defective development of the abdominal walls, the infant needs no artificial support by belly-bands (they are often applied painfully tight), and the cord itself only requires to be dusted with some antiseptic powder (salicylic acid one part, starch ten parts) and wrapped in a bit of antiseptic cotton to absorb its moisture and prevent sticking to the clothing. The stump falls off in about five days, more or less. A light flannel bandage may surround the abdomen *loosely* for the sake of warmth.

CHAPTER XIII.

MANAGEMENT OF MOTHER AND CHILD AFTER DELIVERY.

THE MANAGEMENT OF THE MOTHER.

THE condition of being in "child-bed," whether during or shortly after parturition, is known as the "puerperal state" (from "*puer*," a child, and "*pario*," to bring forth). The term however, is generally restricted to a period of four or five weeks immediately *following* the completion of labor. Hence certain diseases following labor are called "*puerperal*" fever, "*puerperal*" peritonitis, etc. The woman is spoken of as the "*puerpera*" and the condition or period as the "*puerperium*," or "*puerperality*."

The more serious puerperal affections—not of frequent occurrence—will be reserved for a future chapter.

At present only the more trivial and common accompaniments of lying-in will be considered.

General Condition of Lying-in Women.—A moderate amount of fatigue, exhaustion, and nervous shock follows every labor, being more marked in long and painful ones. In normal cases, rest and the mental stimulus of joy that a child is born into the world, and that the trouble is over, afford an adequate antidote.

The pulse, after delivery, diminishes in frequency, dropping to 70, 60, 50, or even lower. A slow pulse is of favorable augury—not so a frequent one. This is explained as follows: the heart, normally hypertrophied to meet the extra circulatory requirements of pregnancy (see page 146), cannot, when pregnancy has ended, continue its powerful beats as frequently as before without sending to the uterus and other organs more blood than they require (with consequent congestion and danger of hemorrhage); nor can the hypertrophied heart *suddenly* undergo its structural involution back to the condition

in which it was before pregnancy began (this requires time); the difficulty is however naturally overcome by the powerful heart reducing the *number* of its pulsations. When this reduction does *not* take place there is danger of bleeding, and hence the common observation that a pulse frequency of 100 or more per minute, is liable to produce post-partum hemorrhage, under which circumstances the physician should not leave his patient.

Owing to a difference of temperature between the blood in the internal organs and that in the skin, which occurs just after the birth of the *child* (and before the placenta is expelled), due to evaporation of sweat, exposure of the skin, and cessation of muscular effort, the woman may be seized with rigors (chilliness, trembling, chattering of the teeth, etc.)—the so-called "*post-partum chill*." It passes off in a few minutes without any ill effects, under the application of warm clothing and perhaps a glass of wine.

Involution of Uterus, Vagina, etc.—By firm contraction and retraction of the uterus after delivery, its bloodvessels are compressed and its blood-supply greatly reduced, hence *involution* of the organ immediately begins. This consists in a process of normal atrophy—a fatty degeneration of the enlarged muscle cells of the uterine wall, by which the size and weight of the uterus are rapidly reduced. The fat granules are absorbed and assimilated as food. Involution becomes complete in about six weeks. During this time the recently delivered uterus, which weighs about two pounds, is reduced to about two ounces—almost but not quite as small as the virgin uterus. Just after labor the fundus uteri may be felt by palpation to be about midway between the pubes and umbilicus. In one week after delivery the uterus loses about one-half its weight by involution, and in about ten days the fundus sinks below the pelvic brim and can no longer be felt by abdominal palpation.

While it is fatty degeneration of the *muscular wall* that especially leads to reduction in size and weight, all other cells of the uterus participate in the fatty degeneration to a certain extent. In fact all the organs composing the reproductive apparatus, including vagina and vulva, have undergone some extra evolution during pregnancy, which is reduced by involution afterward. It is, however, with the uterus that

we are chiefly concerned, for should involution of this organ fail to become complete, the condition known as "*sabinvolution*" would remain, with all the symptoms and miseries produced by a large, heavy, congested, and perhaps displaced uterus.

The Lochia (Lochial Discharge).—It is a discharge from the uterus following labor, consisting during the first four or five days chiefly of blood which has oozed from the placental site or been squeezed from the placenta itself during its expulsion from the uterus. During the sixth and seventh days the blood color should disappear and the discharge assume a thinner and more serous character, with scarcely any color except perhaps a slightly yellowish tinge; at this time it consists of a serous exudation from the walls of the uterus (chiefly) and other parts of the genital canal. From the eighth day on until it ceases—varying in different cases from two to three or even four weeks—the discharge becomes still gradually smaller in quantity and of a whitish color, this last being due to leucocytes and normal pus cells coming from the granulating surfaces of healing wounds upon the cervix or elsewhere. Conformably with these three variations in color, the lochial discharge, during the three successive periods, has been called *lochia rubra*, *lochia serosa*, and *lochia alba*.

Examined microscopically, it is seen to contain at first red and white blood-corpuscles, various kinds of epithelial cells, decidual and placental debris, etc. After a week pus cells and leucocytes abound, with young epithelial cells, fat-granules, connective-tissue cells, and crystals of cholesterin; also a variety of micro-organisms—the diplococci and streptococci, rod-bacteria, the *Trichomonas vaginalis*, sometimes gonococci, and the long bacilli of Döderlein, which last are said to prevent sepsis by developing an acid which destroys poisonous germs.

Treatment.—Antiseptic dressings are applied by the nurse for its reception, as previously explained (page 268). The pads require to be changed, at first six or eight times daily. After three or four days, three or four daily changes may be enough; all depends upon the amount of discharge, which varies in different cases. It is usually greater in those who menstruate freely, in those who do not nurse their children, and in multiparæ. The average quantity during the first eight days is three and a quarter pounds; of this total, nearly two and a quarter pounds are discharged during the first four

days. The quantity cannot, of course, be measured; it can only be judged by the number of napkins or pads used to receive the flow. Sometimes the discharge, after having lost its red color, will again become bloody. This is usually due to getting up too soon after delivery. In such cases put the patient to bed again, and if this alone do not restrain the flow, give ergot three times a day; or tinct. fer. chlorid., gtt. xx, three times daily; or a hot water (110° F.) vaginal injection continued for fifteen minutes. The *most* important matter with regard to the lochia is the early recognition of any disagreeable, really *putrescent odor* it may possess. This calls for immediate investigation and thorough cleansing of the vagina and uterus by antiseptic irrigation (see Puerperal Septicæmia, Chapter XXXIV.). The *normal* odor of the lochia is, in a way, disagreeable, but it is *not* putrescent. During the first few days the natural odor has, not inaptly, been compared to that of raw meat, while later it becomes of a peculiar character difficult to describe, but without any resemblance to putridity. It should be borne in mind, however, that while a *putrescent* odor indicates the presence of putrid matters in the uterus from which *sapramia* may arise, there may also be very bad cases of septic infection *without* any odor of putrescence or any decomposing matter *in utero*. (See Chapter XXXIV., on Puerperal Septicæmia.)

After-pains.—These are painful contractions of the uterus following delivery, for two or three—rarely four days. Often caused by retained blood-clots or membranes, owing to uterus having been imperfectly contracted after expulsion of placenta. Seldom occur in primiparæ. Are worse in short, inactive labors, and in cases where the uterus has been overdistended. The pains are intermittent, accompanied with hardening of the uterus, and are not attended with rise of pulse or temperature, by which they are distinguished from pelvic pain due to inflammation.

Treatment.—After-pains may be prevented by securing complete emptying and firm contraction and retraction of the uterus during the third stage of labor. To relieve them, give two medicines, viz., *ergot*, to produce firm contraction of the womb and the expulsion of any blood-clots, etc., it may contain, and an *anodyne* to lessen the pain of these contractions. Fld. extr. ergot, ʒss, with tr. opii camph., ʒij, may be given

every three hours, or ergot by the mouth and a rectal suppository of morphia. Chloral, 10 grains; Dover's powder, 5 grains; phenacetin, 5 grains, or any other anodyne. Anodyne liniments and hot poultices of hops applied to the hypogastrium will sometimes afford relief. A laxative enema, the woman sitting up during its action (there being no contra-indication to this proceeding, from previous hemorrhage or weakness), will often empty the uterus and secure its firm contraction, relieving after-pains. Digital removal of clots and pieces of membrane lodged in the os uteri may possibly be necessary, but this requires the strictest aseptic technique: in most cases ergot and opium will be sufficient.

When the pains are due to neuralgia of the uterus, give quinia sulphat., gr. v-x.

They also occur from reflex irritation every time the child is put to the breast. Time and patience will relieve this. To lessen suffering give potass. bromide, gr. xx; also anodyne liniments to breasts.

The Bowels.—Laxatives during the first two or three days after labor are not necessary, if the bowels were freely open before delivery. If no action occur spontaneously by the end of the third day a saline laxative—either a Seidlitz powder or a dose of magnesia citrate—may be given; or an enema containing one ounce of castor oil in a pint of soap and water, to which, in case of *tympanites*, a teaspoonful of spirits of *turpentine* may be added. If pills are preferred, give two or three of the pil. rhei comp., or in case a more active purgative be needed, the much-commended "*post-partum pill*" of Fordyce Barker may be given, thus: R. Ext. colocynth. co., ℥j; ext. hyoseyam., gr. xv; pulv. aloes soc., gr. x; ext. nuc. vom., gr. v; podophyllin, ipecac, āā, gr. j. M. Ft. pil. no., xii. S. Take two at once.

The Urine.—The urine may be wholly or partially retained from swelling of the urethra or want of contraction and loss of sensibility in the bladder. Relieve by the catheter three times a day until the parts resume their normal function. Ergot internally stimulates cystic contraction. Hot applications to the pubes or laying the vulva with warm water may afford relief. The woman should be reminded by the nurse to pass urine within eight hours after delivery, otherwise the bladder may become overdistended without the patient per-

ceiving it. Change of posture from recumbency to sitting—there being no contra-indication to it—may enable the woman to pass urine without a catheter, as may also fixing her attention upon the sound of water dribbling into a basin.

When the catheter is used it should have been previously submerged in an antiseptic solution, and the external genitalia should have been cleansed antiseptically to avoid the introduction of vaginal discharge into the bladder. The introduction should be done under direction of the eye, not by the touch. The labia having been separated by the fingers, the meatus of the urethra is *seen*, and the instrument put in. For reasons of delicacy this may preferably be done by the nurse if she possess the requisite skill.

The Diet.—The “toast-and-tea” starvation system after delivery is injurious and obsolete. The woman, however, requires but little food during the first two or three days, for the reason that she is absorbing nutriment from tissues of the involuting uterus—from one to two pounds, lost in weight by the uterus, being thus taken up into the blood, as so much digested food. Moreover, most women store up fat during pregnancy, which can be drawn upon as food without the expenditure of nervous force required in the process of digestion. To lessen this expenditure as far as possible, a liquid diet—chiefly milk—and soup is better for the first two days, or until the milk secretion has been established. The drain occasioned by the milk flow—after the third day generally—creates a want for more food; hence soft-boiled eggs, fish, potatoes, the breast of chicken, oysters, and similar easily digestible substances may be allowed, at first in moderate quantity but gradually increased as the patient is able to digest them.

Milk Fever.—Milk fever is a transient, slight, febrile excitement, preceded by chilliness, attending the establishment of the milk secretion. It scarcely requires treatment, and is far less frequent now than when women were improperly fed and unprotected from septic infection. Recent authorities affirm that “milk fever” is a myth, and that it never occurs. This is for the most part true; the disease has been abolished by proper feeding and antisepsis. Under opposite circumstances it may, however, still come on, as of old.

Sore Nipples (“**Chapped Nipples**”).—The apex and sides of the nipples are affected with fissures like a chapped lip.

There are great pain and some bleeding during suckling ; pain on touching nipple ; fissures visible on inspection ; in severe cases, fever. The agony of suckling and consequent unwillingness to put the child to the nipple may lead to accumulation of milk, followed by inflammation and abscess of the breast.

Treatment—Preventive : Caution the woman against flattening her nipples by pressure of corsets, etc. Keep them *aseptically clean*, for at least a week before delivery, as well as after labor, between the acts of suckling, by frequent applications of a saturated solution of boric acid. The child must not sleep with the nipple in its mouth. After each act of nursing cleanse the nipple with warm water, dry it, and apply a light compress wet with boric acid solution.

Curative : While nursing use a nipple shield—one with hard base and rubber mouth-piece—previously rendered aseptic by immersion in boric acid solution. Each fissure may be touched twice daily with solution of argent. nitras. gr. xx, to water, ʒj, by means of a *very fine* camel's hair pencil. Wet the fissures *only*, not the whole nipple, with the silver solution. This treatment by the silver solution, if conjoined with *abstinence from suckling for twenty-four hours*, is most effective and will sometimes cure in a single day.

Other applications are : Tannin and glycerin, equal parts ; nitrate of lead, grs. x or xx, to vaseline, ʒj ; the tr. benzoin co., applied with a brush, leaves a film over the erosion, lessens pain, and promotes healing ; bismuth subnitrate and castor oil equal parts applied frequently.

Wright uses orthoform, 10 per cent., to lanolin, 90 per cent. It is antiseptic, tasteless, and also produces local anæsthesia lasting for several hours. Many other remedies have been employed. They must be removed, of course, before the child nurses. For slighter and more superficial irritations of the nipple without ulcers or fissures, cleanse and dry them after each act of suckling, and dust with powdered oxide of zinc or gum arabic. Another plan is to keep them moistened with a rag wet with Goulard's extract, ʒij, to water, Oj, carefully washing it off before nursing the child.

Sunken Nipples.—The nipple is too flat, short, or sunken for the mouth of the child to grasp. The infant attempts to nurse, fails, and turns away crying.

Treatment.—Hold the child in readiness while the nipple is first drawn out by the mouth or fingers of an adult, or breast-pump, and then apply it promptly. Another plan: Hold over the nipple the mouth of an empty glass bottle whose contained air has been previously rarefied by heat, till the air cools, and the nipple is drawn up into the neck of the bottle. Then remove it and apply the child immediately. Still another device is to draw out the nipple with the fingers and slip an elastic rubber ring round the base while thus drawn out. The ring must only be worn a few minutes, and must not be tight enough to strangulate the tissues; or, a string having been passed through the ring before it was applied to the nipple, may be gently pulled upon until the ring is lifted away from the skin sufficiently to allow its being cut in two by a blunt pair of scissors while the child is nursing.

Excessive Flow of Milk.—The breasts overflow, or become tender, hard, and distended from accumulation of milk. Danger of inflammation and abscess, if not relieved.

Treatment.—Restrict the woman's diet to dry food, as far as possible abstinence from fluids. Laxatives, preferably salines, to produce watery stools and reduce the fluids of the blood. Diaphoretics (liq. ammon. acetat., \mathfrak{z} ss every two hours) to produce watery secretion from the skin. Locally, R. Ext. belladonnæ, \mathfrak{z} j. liniment. camphor., \mathfrak{z} j. M. Sig. Apply to breasts with gentle friction of the hand. Instead of the belladonna, which is disagreeable and liable in some patients to produce dilatation of the pupil and other constitutional effects of the drug, rapid reabsorption of the milk may be secured by painting the breasts (all but the nipples) with tinct. iodinii, and compressing them with cushions of raw cotton and a bandage.

Large doses of potass. iodid. (gr. xx three times a day) with rigid enforcement of dry, abstemious diet, and moderate, continued compression of the breasts with adhesive plasters, will soon *entirely stop* the secretion of milk, as may be necessary when the child dies or the mother is not able to nurse.

Deficient Milk-flow.—When due to anemia, debility, or hemorrhage, build up the patient with iron, quinia, bitter tonics, and nutritious food, especially *milk*; but of all milk-producing foods the most directly efficacious is *crabs*, whether soft or hard-shelled. Oysters, clams, lobsters, and nearly all kinds of shellfish are also good, care being taken to avoid any

which, owing to idiosyncrasy on the part of the woman, disagree with her. A moderate amount of wine, or preferably malt liquor—lager beer—should be taken with meals. The reputed galactagogue property of fomentations to the breasts of leaves of the castor-oil plant, as well as that of the fluid extract taken internally, has been overrated. The application of electricity has been recently employed with some success as a galactagogue. One of the best vegetable foods is boiled fresh beets, eaten without vinegar.

Artificial Feeding.—If the mother cannot nurse her infant, it must be nourished by a wet-nurse. When none can be obtained, give cow's milk one part (by measure) to two parts of water and add milk sugar, ʒiv to each pint of the mixture, the proportion of milk to be increased with age. When this food disagrees, and the child passes lumps of undigested curd, one-third of the water may be exchanged for lime-water. The water must be sterilized by boiling, and the milk not by boiling, which impairs its nutritive value, but by *Pasteurization*—*i. e.*, by keeping it continuously for thirty minutes at a temperature of 167° F.

It is of the *utmost importance* that nipples, bottles, and vessels in which the food is prepared should be kept aseptically clean. They must *not be used twice* without being thoroughly cleansed—the bottles and vessels scalded and the nipples immersed in a solution of boric acid. The best rule as to how much of the milk-mixture should be given the child *at one time*, is to give it as much as it will *readily take*; if it reject any, give it less next time.

How Long Should the Mother Keep Her Bed after Labor?—The popular, conventional rule is *nine days*. It is a custom without reason. Some strong, vigorous women with healthy and well contracted uteri might get up sooner; others require a much longer period. Everything depends upon the character and complications of the labor, the strength of the woman, and the condition of the uterus. Too early getting up, while the womb is large and heavy, and its natural supports relaxed from the stretching of pregnancy and labor, endangers uterine displacements, congestion, return of bloody lochia, and subinvolution. It is better to err on the safe side by making the lying-in too long, than to risk too early rising. Two weeks in bed is a good rule; during the third week the woman

(if all goes well) may move about her room and at the end of the fourth, leave it.

Suckling the Child.—The infant may be put to the breast as soon as it is washed, dressed, and ready for the mother, provided she be not over-tired. If she be, let her rest a few hours. The child may nurse about every four hours during the first day or two, before the flow of milk begins. After then, more frequently, every *two* hours, except from 11 P. M. to 5 A. M., when the mother should be allowed continuous sleep. When the child is six months old, five or six times in twenty-four hours will be sufficient.

The breasts should be suckled alternately—first one, then the other—and the nipples tenderly cleansed with a 4 per cent. solution of borax and water before and after each act of nursing.

The flow of milk is not usually established until the second or third day after delivery. During these first days there is, however, a little imperfectly formed yellowish milk, known as the “colostrum” (see page 65), which is enough for the infant without the addition of any artificial food, and acts upon it as a laxative to remove the “meconium,” or native contents of the intestinal canal, consisting of unabsorbed bile, mucus, etc.

THE MANAGEMENT OF THE CHILD.

Laxatives for the Infant.—If the child’s bowels fail to move spontaneously, which is rare, a little “pinch” of brown sugar dissolved in a teaspoonful of water may be given; or half a teaspoonful of olive oil, or a little enema of soap and water, or a small rectal suppository of glycerin. Before giving any laxative it must be known that the child is not suffering from imperforate anus. If the mother be constipated, laxatives given to her will reappear in the milk, and operate on the child.

The first evacuations from the child are black in color, slightly tinged with green; they become yellow in a few days.

The Infant’s Urine.—If upon inquiry the child is reported not to have passed urine during the first day after delivery, examine the urethra and meatus for congenital deformity; feel above the pubes, whether its bladder be distended, and ascertain that the urine has not been voided in the bath unawares.

If the bladder be full, a sprinkle of cold water on the hypogastrium, or a warm bath, may answer. A very small elastic catheter may, *very rarely*, be required.

Most cases of apparent retention of urine are really due to non-secretion; the infant takes but little food, and may excrete but little urine. Let it alone.

Infantile Jaundice (*Icterus Neonatorum*).—A common affection during the first week of infant life.

Symptoms.—Yellow skin and conjunctiva; high-colored urine; light-colored stools.

Causes.—Recently it has been ascribed to septic infection through the navel, especially in lying-in hospitals. The tight application of belly-bands, restricting the respiratory motions of the abdominal walls and diaphragm, upon which the portal circulation chiefly depends, is probably a factor in the production of the disease. It occurs more frequently in premature infants; in boys than girls; in the children of primiparæ, and in cases of malpresentation.

Treatment.—Nothing further than the removal of belly-bands may be necessary in slight cases. It soon goes away. In severe cases with constipation, give calomel one-sixth of a grain, with one grain of white sugar, in powder, three times a day, for one or two days, followed by a teaspoonful of olive or castor oil.

In some cases there is *apparent* but no *real* jaundice. The skin is colored, while other symptoms are absent. It passes off without treatment.

Sore Navel.—An ulcer, usually with sprouting, flabby granulations, remains after falling off of stump of funis. Usually caused by friction and pressure of bandages too tightly applied; may also be due to septic infection.

Treatment.—Remove all dressings and bandages. Cleanse thoroughly with boric acid solution. Touch the granulations with pencil of argent. nit. Then dust navel with antiseptic powder of salicylic acid and starch (1:10) and cover with antiseptic cotton. In some cases the fungous granulation, after cauterization, fails to disappear; it persists, becomes solid, and perhaps pediculated like a little polypus. The mass should be ligated and cut off.

Umbilical Hernia.—In the common form of umbilical hernia in infants a soft protrusion, about the size of a finger-

end, projects at the navel. It becomes more tense and prominent when the child cries. It is easily reduced by digital pressure, and the finger can then feel the sharp borders of the ring through which it came out.

Treatment.—A round disk of wood, a coin, or a button is wrapped in lint or some soft material, and kept in position over the umbilicus with a light elastic bandage or with strips of adhesive plaster, these appliances to be removed for cleansing purposes and replaced. Recovery occurs with subsequent closure of the ring.

A much more serious form of umbilical hernia *rarely* occurs, with imperfect development of the abdominal wall, in which *large* protrusions of intestine and other abdominal organs take place. These require a plastic surgical operation.

Secondary Hemorrhage from the Umbilicus.—A dangerous and often fatal bleeding from the navel, coming on days, or even weeks after delivery, and recurring (sometimes) again and again, in spite of styptics, ligatures, the actual cautery, and other means that must be promptly tried for its relief. The best plan is to transfix the base of the navel with two harelip pins, and pass a figure-of-8 ligature around the ends of each pin, so as to compress the bleeding vessels. Remove pins in five days and leave ligatures to come away of themselves with the ligated tissue, strict antisepsis to be observed both during the transfixion and subsequent dressings.

Inflamed Breasts.—In young infants of either sex, one or both of the breasts may become red, tender, and swollen. On pressure a few drops of milky fluid may be squeezed out, but this pressure should *never be allowed* or practised. Let the breasts entirely alone. The trouble will disappear of itself in four or five days. If attempts are foolishly made to press out the milk, pus may form, and a lancet be required to open the little abscess, always under antiseptic precautions.

Ophthalmia Neonatorum.—Ophthalmia neonatorum is an infectious purulent conjunctivitis, due to the gonococcus or some other pyogenic germ, and produced by contact with the eye of vaginal secretion from the mother during labor, or by infected fingers, instruments, cloths, etc. Statistics show that blindness in adults in about one-fourth of all cases is due to this disease.

Symptoms.—*Great swelling* and sometimes bleeding of the eyelids; the ocular and palpebral conjunctivæ are red from *intense hyperæmia*, and the skin of the lids is often of a dusky red or bluish color; *profuse purulent discharge* of a gray, green, or yellow tint. The conjunctiva swells around the cornea, so that the latter appears sunk down in a circular depression. Bad cases go on to ulceration and sloughing of the cornea, with perforation into anterior chamber, if not properly and promptly treated.

Treatment.—Keep the eyes clean and free from accumulated pus by washing them every half hour with a saturated solution of boric acid, lids to be separated as widely as possible, and the solution dropped in plentifully; or the bulbous tip of a glass eye-dropper is placed alternately in the inner and outer angles of the lids and the solution slowly injected within them. In place of the boric acid some prefer a 1 : 5000 bichloride of mercury solution used in the same way. Beside this antiseptic cleansing, which must be faithfully done, both day and night (hence *two nurses* are required), drop into each eye, every night and every morning, two drops of a two per cent. solution of silver nitrate. After each washing place over the eye a light wet compress, kept cold by contact with ice. As the symptoms become less acute, use the silver solution *once* a day and reduce its strength to 1 per cent., the boric acid (or bichloride) solution to be continued until cure is complete. Inform relatives to beware of contagion. Isolate patient and burn all cloths, compresses, etc., once used. In labor cases when infection is feared, use one drop of a 2 per cent. silver nitrate solution in each eye as a prophylactic measure.

CHAPTER XIV.

MECHANISM OF LABOR IN HEAD PRESENTATIONS.

By the mechanism of labor we understand the operation of the mechanical *forces*, and the execution of the mechanical *movements* necessary to secure the passage of the child through, and its exit from the pelvic (or rather parturient) canal.

In studying it there are *six presentations* to be considered, viz. :

- | | |
|--------------------------|------------------------------|
| 1. Head presentations. | 4. Knee presentations. |
| 2. Face presentations. | 5. Feet presentations. |
| 3. Breech presentations. | 6. Transverse presentations. |

Posture or "Attitude" ¹ of Child in Uterus.—The posture of the child *in utero* is very much that of an adult when trying to keep warm in a cold bed before going to sleep, viz. : the spine curved forward, the face bowed toward the chest, the thighs flexed upon the abdomen, the legs toward the thighs, and the arms flexed and folded across the breast. The child, *in utero*, thus flexed and folded, is more compact and occupies less space than it could in any other posture ; its whole frame approaches the *ovoid form* of the uterine cavity in which it reposes.

Now, when either *end* of this foetal ovoid presents, other things being normal, delivery is mechanically possible. When it presents *crosswise*, delivery is impossible. Hence, presentations of the head, face, breech, knees, and feet may be considered *natural* presentations ; while transverse presentations are *preternatural*. Sometimes head and face presentations are called "cephalic" presentations, because the cephalic (or brain) *end* of the ovoid presents ; while breech, knee, and footling presentations are termed "pelvic" presentations,

¹ The technical term "*attitude*" therefore means the relation which the different parts of the child's body bear to each other—a meaning quite different from the terms "*presentation*" and "*position*," as will be seen immediately. Vide Appendix on Uniformity in Obstetrical Nomenclature.

FIG. 101.



L. O. A.

FIG. 102.



R. O. A.

FIG. 103.



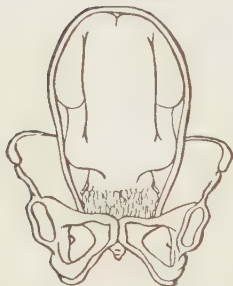
R. O. P.

FIG. 104.



L. O. P.

FIG. 105.



EXCEPTIONAL.

FIG. 106.



EXCEPTIONAL.

Figs. 101-106 represent the six positions of the occiput.

because the pelvic or caudal *end* of the ovoid comes first. The long spinal column *must* come one end first—either head or tail.

HEAD PRESENTATIONS.

Cases in which the head presents at the os uteri or pelvic brim.

The Four "Positions" of Head Presentations.—By the term "*position*," as applied in the mechanism of labor, we mean the *positional relation existing between a given point on the presenting part and certain other given points upon the pelvis*. In head presentation the *occiput* is the given point on the presenting part, and the given points on the pelvis are the *two acetabula* and the *two sacro-iliac synchondroses*. Thus the *four positions* of a real presentation are :

1. Occiput to *left acetabulum* (left occipito-anterior)¹ (occipito-læva-anterior).

2. Occiput to *right acetabulum* (right occipito-anterior) (occipito-dextra-anterior).

3. Occiput to *left sacro-iliac synchondrosis* (left occipito-posterior) (occipito-læva-posterior).

4. Occiput to *right sacro-iliac synchondrosis* (right occipito-posterior) (occipito-dextra-posterior).

Very rarely the occiput points directly in front, to the symphysis pubis, or directly behind, to the sacral promontory, thus making *two* more positions (*six* in all). But these two may be left out. They usually become converted into one of the other four at the beginning of labor.

The order of greatest *frequency* of the four positions is as follows :

First. Occiput to *left acetabulum*, L. O. A.²

Second. Occiput to *right sacro-iliac synchondrosis*, R. O. P.

Third. Occiput to *right acetabulum*, R. O. A.

Fourth. Occiput to *left sacro-iliac synchondrosis*, L. O. P.

This order of frequency is worth remembering, but to *call* the positions first, second, third, and fourth is worse than useless, and had better be omitted.³

¹ So called because the occiput is pointing to the *left* and *forward*. The same plan of nomenclature is applied to the other positions.

² L. O. A., Left Occipito-Anterior; L. O. P., Left Occipito-Posterior.

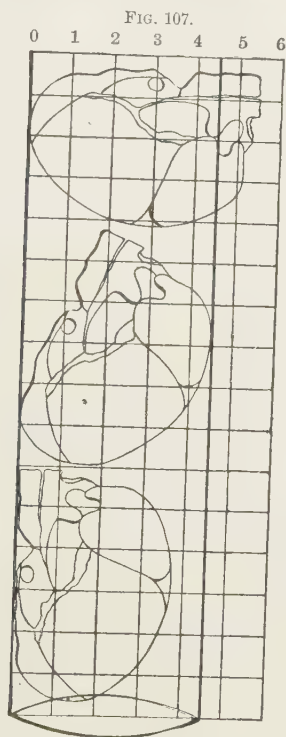
³ Nægele stated that in every 100 vertex presentations, 70 are L. O. A. positions and 30 R. O. P., all others being extremely rare exceptions. Prof. Cameron's figures are: L. O. A., 67; R. O. P., 20; R. O. A., 10; and L. O. P., 3 per cent.

If the student be not already familiar with the terms and measurements given in describing the pelvis (Chapter I.) and foetal head (Chapter II.), he should review them before attempting to learn the mechanism of labor. In the following description it is designed to give only the *main principles* of the mechanism, leaving exceptional occurrences and slight deviations and obliquities, of no great practical value, entirely out. A simple outline sketch had better be learned first. The finer shades of variation can be put in afterward. Mixture is confusion.

Stages of Mechanism in Head Presentations.—These are : 1. Flexion. 2. Descent. 3. Rotation. 4. Extension. 5. Restitution or external rotation.

Mechanism in Left Occipito-anterior Position (Occiput to Left Acetabulum).—1. *Flexion.* It must be remembered that the foetal head is (roughly) egg-shaped, and measures, from the *big* end of it to the *little* end (from the occiput to the chin), $5\frac{1}{2}$ inches. While the occipital pole of the head is at the left acetabulum, the chin-pole must be somewhere toward the right sacro-iliac synchondrosis, and a line drawn between these two pelvic points is one of the oblique diameters of the brim, and measures $4\frac{1}{2}$ inches. Is a head diameter of $5\frac{1}{2}$ inches, then, trying to pass a pelvic diameter of $4\frac{1}{2}$? No; the bowed attitude of the child's head *in utero*, already mentioned, keeps its chin-pole tilted *up* toward the uterine cavity, and the occipital pole tilted *down* toward the os uteri and pelvis, so that the forehead instead of the chin is really at the right sacro-iliac synchondrosis, and it is, therefore, the occipito-frontal diameter of the head ($4\frac{1}{2}$ inches in length) that is apparently trying to go through the oblique pelvic diameter of $4\frac{1}{2}$. But this would be too tight a fit. The chin must be tilted yet more decidedly toward the sternum of the child, and the occiput be made to dip more decidedly toward the entrance of the pelvis, in order that the oval-shaped head may enter the brim more or less endwise. This is *flexion*, so called because the child's neck is *flexed*, and the chin pressed against the sternum. Fig. 107 shows diagrammatically, the effect of flexion in permitting descent. In the upper head, unflexed, it is seen the $5\frac{1}{2}$ -inch occipito-mental diameter cannot enter the $4\frac{1}{2}$ -inch diameter of the brim (represented by the ring at the lower part of the figure). The middle head is flexed sufficiently to descend.

The lower head shows an impossible degree of flexion—impossible when the head is attached to the neck—and undesirable, as it would permit the head almost to drop through the pelvis. The lines and numerals represent inches.



Influence of flexion in permitting descent.

What *causes* flexion? The force of uterine contraction is transmitted through the body of the child to its head by means of the spinal column, but the cervical end of the spine, where it joins the cranium, is *not in the centre* of the base of the skull, midway between the two poles, but is *nearer the occipital pole*; this last, therefore, bears the brunt of uterine force and is made to dip down lower than the other pole. More-

over, the two poles meeting equal resistance from the circle of the os uteri and pelvic brim, the resisting force exerted upon the chin or frontal pole will be more effective because it is acting on the end of a longer lever than that applied to the occiput, hence the chin and forehead are tilted upward.

It must be admitted, however, that flexion of the head is its normal attitude during pregnancy before labor begins, and when therefore the *causes* of flexion must be different from those just described; but that the flexion, when insufficient, is increased during labor in the manner above mentioned appears reasonable. Whatever differences of opinion may be held as to the manner in which flexion is produced, one thing is certain, viz.: the flexion *must occur* or the head cannot descend. Hence, whether we regard it as taking place during pregnancy or only during labor, it is a necessary step, and the first step in the mechanism by which the head is enabled to pass through the pelvic canal. An *unflexed* head cannot pass; and in proportion as the pelvis is generally contracted the flexion requires to be increased.

While the long (occipito-frontal) diameter of the head is more or less parallel with *one* oblique diameter of the pelvic brim, the transverse or biparietal diameter ($3\frac{1}{2}$ inches) occupies the *other* oblique ($4\frac{1}{2}$). Hence there is plenty of room for *that* to pass. The biparietal diameter is also *about* on a level with the *plane* of the superior strait, owing to the fundus uteri being so tilted forward as to bring the uterine axis in a line with the *axis* of the plane of the brim.

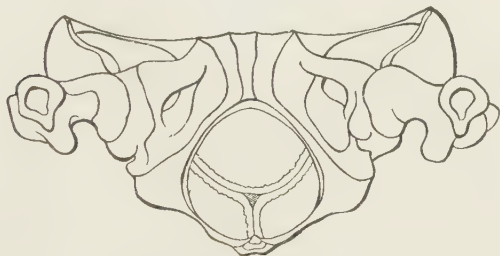
2. *Descent*.—The head having been tilted endwise by flexion, it enters, occiput first, the pelvic brim, and *descends* into the pelvic cavity. It goes on down (the occiput still toward the left acetabulum and forehead toward the right sacro-iliac synchondrosis) until reaching the pelvic floor (the bottom of the basin).

While flexion and descent are thus described as separate processes, and while the former is necessary to the latter, it must not be supposed that flexion is complete before descent begins; on the contrary, they go on simultaneously, each increment of flexion being accompanied by an increment of descent. In fact the whole process of labor, from beginning to end, is a descent or progression of the head and body of the child, from the inlet of the pelvis above to its

exit at the outlet below. Descent can only be profitably considered as a separate process in that it is one that must take place, before the next step, viz., rotation, can become possible.

3. *Rotation*.—The head having descended to the pelvic floor, its occipito-frontal diameter ($4\frac{1}{2}$) now occupies the oblique diameter of the *inferior* strait, which, however, measures *only four inches*. It cannot go on. Something must occur to bring the long diameter of the head parallel with the *antero-posterior* diameter of the outlet, which we know measures $4\frac{1}{2}$ inches or even 5 when the coccyx is pushed back. This is accomplished by rotation. Near the end of its “descent” the occiput strikes

FIG. 108.



Occiput at inferior strait after rotation.

the pelvic floor and the slanting surface of bone in front of the ischial spine—the so-called left *anterior inclined plane*—and gliding downward, forward, and inward toward the median line, it reaches the symphysis pubis, while the forehead, rotating downward, *backward*, and inward toward the median line (along the right *posterior* inclined plane), reaches the centre of the sacrum. Thus the ovoid head has come to occupy a position agreeing with the longest (antero-posterior) diameter of the outlet and the occipital pole is almost ready to escape, endwise, through the inferior strait. (Fig. 108.)

The influence of the “inclined planes” in causing rotation has latterly been doubted; and other theoretical explanations have been given. But these theories are of no very great moment. The practical fact remains, that in the normal mechanism of labor the head does and must rotate in the manner described.

4. *Extension*.—The head now stretches the perineum and soft parts into a kind of gutter, which constitutes the fleshy continuation of the parturient canal. The occiput descends below the symphysis pubis and passes on between the pubic rami, until the biparietal equator of the head fits into the pubic arch. The back of the child's neck meanwhile fits squarely against the posterior surface of the pubic symphysis, and resting there immovably, the force of uterine contraction is expended upon the chin-pole of the head: hence, as soon as the resistance of the soft parts permits the occiput to begin to escape, the chin is released from its condition of flexion, and extension is said to have begun. Finally the forehead slips

FIG. 109.



Upward extension of occiput.

by the projecting coccyx, the parietal equator of the head emerges from the vaginal orifice, and the immediate retraction of the elastic perineum over, successively, forehead, nose, mouth, and chin, causes the occiput to rise up outside and in front of the pubes toward the mons veneris. Thus delivery takes place by the head describing a circular movement round the fixed centre of the pubic arch—a movement exactly the reverse of flexion, viz., *extension*. (See Fig. 109.) Remember the *direction* of extension in this L. O. A. position is such as to make the occipital pole go *upward* and *forward* toward the mons veneris. In the R. O. P. and L. O. P. positions we shall see this sometimes reversed.

It is worthy of remark and illustrates nature's adaptation of means to ends—in this case the adaptation of passenger to passage—that when anterior rotation of the occiput is complete and the head is about to escape by extension, *the projecting coccyx comes exactly in contact with the anterior fontanelle*, whose yielding surface offers less resistance than a hard bony one would. (See Fig. 108, page 289.)

FIG. 110.



Restitution.

5. *Restitution (External Rotation)*.—The head, after being completely born by extension, hangs out of the vagina; the chin dropping toward the anus, the vaginal orifice encircles the neck. The head next twists, or rotates, in such a manner as to bring the occiput toward the mother's left thigh—the thigh corresponding to the acetabulum at which it originally presented. The purpose of this manœuvre is to facilitate delivery of the shoulders. Their longest diameter is, of course, the bisacromial—from one acromion process to the other. This diameter entered the brim and descended into the cavity of the pelvis, parallel with the oblique pelvic diameter extending from the right acetabulum to the left sacro-iliac synchondrosis. But having reached the *inferior* strait, the bisacromial diameter must rotate from its oblique direction in the pelvis to the antero-posterior one. Hence the right shoulder—the one nearer the pubes—rotates to the pubes; the left shoulder—

the one nearer the sacrum—rotates to the sacrum. This rotation of the shoulders *inside* the pelvis causes rotation of the head *outside* of it. The shoulder at the pubes usually fixes itself there, while the other one at the perineum swings round, describing a circular movement (as the occiput did), and comes out first. (See Fig. 110.)

When the shoulders are delivered the rest of the body usually slips out at once, without any special mechanism.

Mechanism of R. O. A. Position (Occiput to Right Acetabulum).—1. *Flexion*, by which the chin tilts up and the occiput down, so as to get the long diameter of the head more or less endwise to the pelvic brim.

2. *Descent*, by which the head descends, occiput first, through the brim, into the cavity, down to the inclined planes of the pelvic floor.

3. *Rotation*, by which occiput glides along *right* anterior inclined plane, downward, forward, and inward to symphysis pubis; and forehead glides along *left* posterior inclined plane to middle of sacrum.

4. *Extension*, by which occiput escapes under pubic arch and rises up outside, toward mons veneris, while forehead, nose, mouth, and chin successively escape at perineum.

5. *Restitution* (external rotation), by which occiput turns toward mother's *right* thigh (the thigh corresponding to acetabulum at which it originally presented), in consequence of shoulders rotating upon inclined planes—left shoulder to pubes, right to coccyx; the latter one generally escapes first. Delivery of the body.

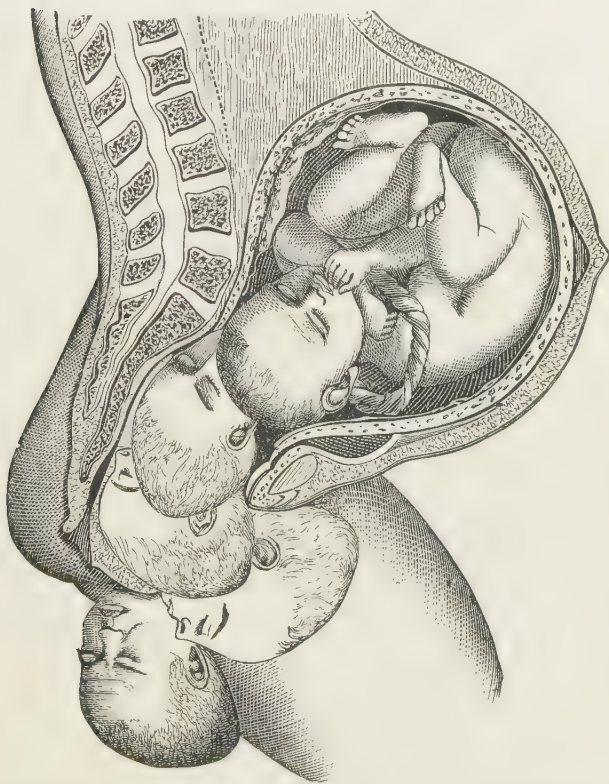
Thus we have described the two *anterior* positions of the occiput: L. O. A. and R. O. A. Next come the two *posterior* ones.

Mechanism of R. O. P. Position (Occiput to Right Sacroiliac Synchronosis).—1. *Flexion*. 2. *Descent*, as in anterior positions of the occiput.

3. *Rotation*.—In the large majority of cases (96 per cent.) the occiput rotates all the way round to the symphysis pubis. In doing so it passes the right acetabulum, but it no sooner reaches this point than it becomes practically and in reality a right *anterior* position, and the rest of the mechanism is *precisely* the same as already described for the R. O. A. position.

In the small minority of cases (4 per cent.) the occiput, instead of rotating forward, *rotates backward* to the sacrum, and the forehead comes to the pubes.

FIG. 111.



Diagrammatic view of mechanism in a left-occipito-anterior position of a head presentation. (After LEISHMAN.)¹

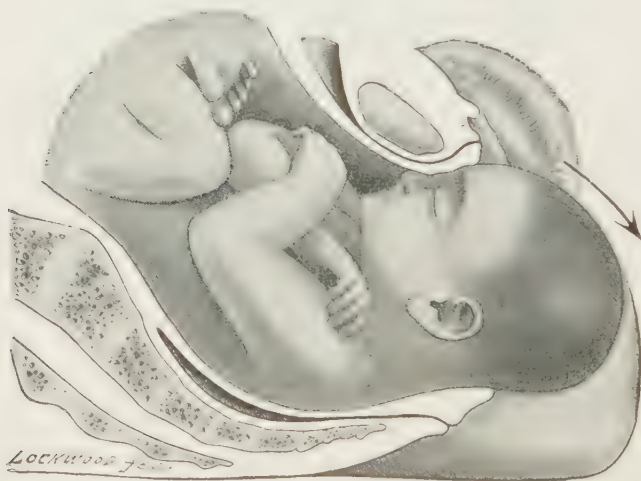
Then follows, 4, *Extension*, which takes place, not upward toward the mons veneris, but the occiput escapes over the

¹To understand Figs. 111, 113, and 124, turn the book around, so that the abdominal surface in each drawing is directed upward, the dorsal surface downward.

perineum, and is depressed outside of it downward and backward toward the anus, while forehead, nose, mouth, and chin, successively emerge under the pubic arch. (See Fig. 112.)

5. *Restitution*.—By internal rotation of the shoulders, as already explained, one goes to pubes, the other to sacrum, and the occiput rolls around to the right thigh—the thigh corresponding to the sacro-iliac synchondrosis at which it originally presented).

FIG. 112.



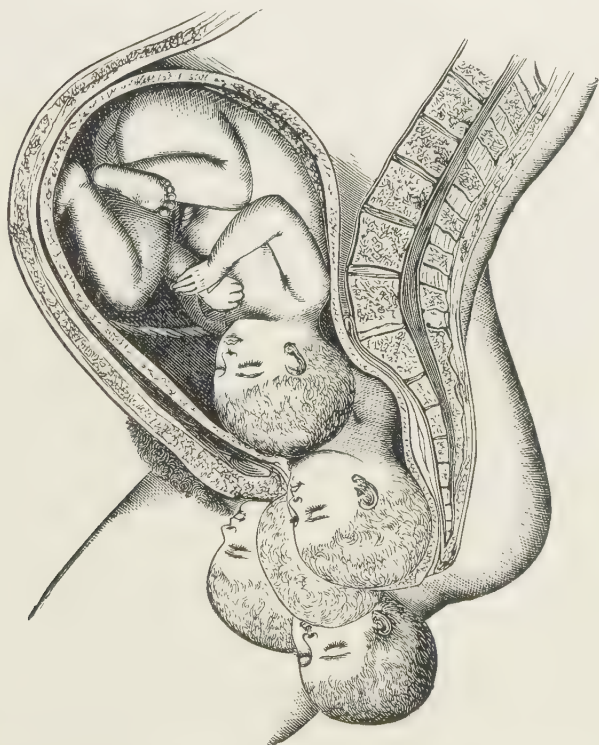
Delivery about to occur by backward extension, in direction of arrow, down over the perineum. (After WILLIAMS.)

Mechanism of L. O. P. Position (Occiput to Left Sacro-iliac Synchondrosis).—1. *Flexion*. 2. *Descent*. 3. *Rotation*, in the majority of cases all the way round to the symphysis pubis (when, on reaching left acetabulum, it, of course, becomes converted into a L. O. A. position); in the minority of cases, backward rotation of occiput to sacrum.

4. *Extension* of occiput downward and backward over perineum, while forehead, nose, and chin, successively escape under pubic arch.

5. *Restitution*, internally of shoulders, right one to pubes, left to coccyx; externally of occiput to left thigh (thigh corresponding to the sacro-iliac synchondrosis at which it originally presented).

FIG. 113.



Diagrammatic view of mechanism in R. O. P. position, after *posterior* rotation of occiput.

Explanation of Posterior Rotation.—In those few cases of occipito-posterior positions where the occiput rotates to the sacrum, the circumstance is due to *imperfect flexion* of the head, so that the forehead is too low. In reality it is, there-

fore, anterior rotation of the forehead which causes posterior rotation of the occiput, in obedience to a general rule, that whichever pole of the head is the lowest in the pelvis will rotate to the pubic symphysis. Occasionally, however, the forehead, being lowest, will stick near the acetabulum, and then rise again, permitting the occiput to descend along the opposite sacro-iliac synchondrosis, when anterior rotation of the occiput, all the way round to the pubes, will take place just as the head is about to escape from the vulva.

Still another variation may occur when the occiput *has* rotated posteriorly, viz., instead of the occipital pole escaping over the margin of the perineum, the forehead, nose, and chin successively escape *first* under the pubic arch, when the chin rises up toward the mons veneris, and the occiput comes out *last* at the perineum. In fact the case is converted into a face presentation just before the head is born. This modification of the usual mechanism is exceptional.

Diagnosis of the "Position" in Head Presentations.—In the L. O. A. and L. O. P. positions, the part of the head first touched by the examining finger is the right parietal bone; in the R. O. A. and R. O. P. positions it is the left parietal bone. In either case it is that parietal bone which lies nearest the pubes. This is easily understood by remembering that the head enters the pelvis in a line with the long axis of the uterus, which agrees with the axis of the plane of the superior strait, while the finger enters the pelvis from below, and more in a line with the axis of the inferior strait, so that it necessarily touches the *side* of the presenting head. One parietal bone looks upward and backward, toward the sacral promontory, the other downward and forward toward the pubes. The latter one is touched first. Then by pushing the finger a little higher up and further backward toward the sacrum, the sagittal suture, running between the parietal bones, may be felt extending obliquely across the pelvis between the acetabulum and opposite sacro-iliac synchondrosis. If it be a L. O. A. position, the finger, by following the sagittal suture toward the left acetabulum, will there find the small triangular fontanelle at the junction of the sagittal and lambdoidal sutures. If it be a R. O. A. position, this fontanelle will be discovered by following the same suture toward the right acetabulum. If it be a R. O. P. posi-

tion, following the sagittal suture toward the *left* acetabulum will *not* bring the finger to the *little* fontanelle, but to the large membranous anterior one. So in a L. O. P. position, the finger will find the large fontanelle at the *right* acetabulum, by following the sagittal suture in that direction. In the two posterior positions (last mentioned) the small triangular fontanelle cannot be touched at all—it is entirely out of reach by the usual digital examination.

In short, having felt the sagittal suture, follow it toward the acetabulum to which it points (it *must* point to one or the other), and there will be found the *posterior* fontanelle in *anterior* positions of the occiput (right or left, as the case may be); or the *anterior* fontanelle in *posterior* positions of the occiput (either right or left).

Later in the labor, when rotation has taken place, the posterior triangular fontanelle, in anterior positions, will be felt toward the symphysis pubis, the sagittal suture running backward toward the sacrum; while in those posterior positions where anterior rotation of the occiput does not take place, the large, membranous, unmistakable anterior fontanelle will be felt toward the pubic symphysis.

The mode of making out the *position* in head presentations by *palpation*, viz., by recognizing the relative position of the child's *back*, *forehead*, and occiput, has been already explained. (See Chapter XII.)

Prognosis and Treatment of Occipito-anterior Positions.—Prognosis favorable in so far as the mechanism is concerned, and no assistance required in ordinary cases other than general attentions already mentioned under “The Management of Labor.”

Prognosis and Treatment of Occipito-posterior Positions.—In the majority of cases the same as in anterior positions. In the minority of cases, where anterior rotation of the occiput fails to take place, a long and difficult labor may be anticipated, owing to the difficulty the occiput encounters in escaping over the perineum, on account of the posterior (sacral) wall of the pelvis being so much deeper than the anterior (pubic) one. Forceps may be required to complete delivery, the short straight ones being preferred. The perineum is enormously distended and requires additional care to prevent rupture.

Various expedients have been devised to promote anterior rotation of the occiput when it does not occur spontaneously. Thus, since we know posterior rotation is generally the result of *imperfect flexion* (the forehead being too low, the occiput too high), we may strive to remedy the difficulty by *making flexion perfect*. This can be done by pressing two fingers of one hand upon the forehead during the pains so as to push it up, or at least keep it from coming lower, while the force of uterine contraction is then expended in depressing the occiput. A vectis may at the same time be applied over the occiput to assist in pulling it down. The object is to get the occiput so low that it will pass *below* the spine of the ischium to the anterior inclined plane and rotate *forward*, while the forehead is kept high enough to pass *above* the opposite ischial spine and rotate backward. Rotation forward may sometimes be accomplished with forceps while making traction. (See "Forceps" page 364.)

If the pelvis be large and the operator's hand small, the latter may be passed in alongside of the head, and the occiput drawn obliquely downward and forward to the pubes. Another plan: Etherize to full anaesthesia. Pass a hand into vagina; grasp head, and steadily and gently push it up out of the pelvis, *above superior strait*. Then flex it, and rotate occiput forward. Hold it so until the pains, aided by pressure of other hand on abdomen, push it down again into pelvis, in its now occipito-anterior position. Forceps may be required to complete the delivery.

Another way to produce anterior rotation of the occiput is that of Herman, and consists in rotating the *body* of the child by abdominal palpation. It can only be done when the head is above the brim and the bag of waters is unruptured, thus the *shoulder* of the child that is in front toward one of the acetabula is gently manipulated laterally across the abdomen until it reach the *opposite* acetabulum. This brings the occiput from the sacro-iliac synchondrosis to the acetabulum of the same side. Here it may be held over the brim until it become fixed; or it may be secured by an abdominal binder; or the membranes may be ruptured.

A device, somewhat similar in principle, is that of Tarnier, who places an index finger in the os uteri *behind the ear* that is toward one of the acetabula, keeps it there until a contrac-

tion begins, and then during the pain, forces the ear across the anterior wall of the uterus in front, until it reach the *opposite* acetabulum. This rotates the occiput from the sacro-iliac synchondrosis to the corresponding acetabulum. It is best done at the end of the first stage of labor, and may be continued during several pains, if not at first successful. This of course is an *internal* rotation, while Herman's method of pressing round the shoulder and body is done by *external* manipulation. Both may be done conjointly by one or two operators if necessary.

Posterior rotation of the occiput is especially likely to occur when the head is unusually *large*.

When, in occipito-posterior positions, the occiput *has* already performed *posterior rotation*—that is, when it has gone from the sacro-iliac synchondrosis to the hollow of the sacrum, no further attempts should be made to bring it forward; it must be delivered with the occiput behind, the straight forceps being used, in order to allow backward extension of the occiput down over the perineum.

Recently symphysectomy has been successfully resorted to in cases of impaction where the child has not already been seriously injured by attempts to deliver in other ways.

Finally, it is especially in occipito-posterior cases that *time* and *patience* are required to allow *moulding* of the head, and *dilatation* of the soft parts; but assistance must be promptly rendered at the very beginning of symptoms indicating approaching exhaustion of either the woman or womb; by forceps when the head has descended below the superior strait; by version when it has not—the other conditions suitable for these operations being present.

CHAPTER XV.

FACE PRESENTATIONS.

IN face presentations the child's head, instead of being flexed, is extended, so that the *chin* end of the occipito-mental diameter is tilted down toward the entrance of the pelvis, while the occipital end is pressed up toward the child's *back*, just as the chin was pressed toward the child's sternum in head presentations.

Causes.—Any projection between chin and sternum interfering mechanically with flexion of the chin, such as congenital goitre or other tumors; hydrothorax; several coils of funis round the neck, etc.; any projection mechanically arresting descent of the occiput, and thus again obstructing flexion, such as ovarian, fibroid, or other tumors of the mother's parts; narrow pelvis; a very large or *long* fetal head; *excessive lateral obliquity of the uterus*. This last is the most common cause. It produces extension, and consequently face presentation, in the following manner: Most cases of face presentation were at first head presentations. Now, if the occiput were toward the left acetabulum in an ordinary head presentation, and the fundus uteri were tilted much toward the right side, the direction of force of uterine contraction would be such as to press the occipital pole of the occipito-mental diameter upon the left edge of the pelvic brim, where it would remain solidly fixed, and the uterine force would then operate upon the other (chin) end, and force it down into the pelvic cavity, and a face presentation would result. Thus it is that posterior *positions* of face presentation are more frequent than anterior ones; they were changed *head* presentations, and the *position* in head cases is usually occipito-anterior; *when* changed, as just described, the chin is directed behind.

Very rarely the face presents originally, and is *not* a deviated head case; these are supposed to occur from the child having had convulsions *in utero* (opisthotonos).

FIG. 114.



L. M. A.

FIG. 115.



R. M. A.

FIG. 116.



R. M. P.

FIG. 117.



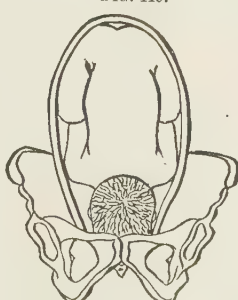
L. M. P.

FIG. 118.



EXCEPTIONAL.

FIG. 119.



EXCEPTIONAL.

FIGS. 114-119.—Six positions of face presentation.

Positions of Face Presentation.—The given point on the presenting part from which the positions of a face presentation are named is the chin (Latin, "*mentum*").

FIG. 120.



Transverse position of face at superior strait.

The *number* of positions, like those of the occiput, is four, as follows :

1. Chin to left acetabulum (left mento-anterior), L. M. A. (mento-læva-anterior).
2. Chin to right acetabulum (right mento-anterior), R. M. A. (mento-dextra-anterior).

3. Chin to right sacro-iliac synchondrosis (right mento-posterior), R. M. P. (mento-dextra-posterior).

4. Chin to left sacro-iliac synchondrosis (left mento-posterior), L. M. P. (mento-læva-posterior).

The directly antero-posterior positions of face presentations, as seen in Figs. 118 and 119, are so extremely rare as to be almost never met with in practice. They are, however, possible, and when they occur, are spontaneously converted into one of the other four positions (represented by Figs. 114-117) during the progress of labor.

The relative frequency of the several positions has not been positively ascertained, but the mento-posterior positions are more frequent than the mento-anterior ones. While the four *positions* of the face have been named according to the same plan adopted for the occiput, it may be stated that the chin is often *not exactly* at either acetabulum or sacro-iliac synchondrosis, but at some point between the two—*i. e.*, nearer the centre of the ilium, and hence the positions are called in some books simply right and left *mento-iliac*. (See Fig. 120.) The *chin*, however, will arrive at the acetabulum or sacro-iliac synchondrosis during the labor, and the plan we have adopted we think is best.

Frequency of Face Presentations.—They occur once in about 250 labors.

Mechanism of Face Cases.—The whole matter is easily understood by remembering that the *chin* is the mechanical equivalent of the occiput, and follows the same mechanical movements as the occiput does in head presentations. The chin end of the egg-shaped head comes first. The several stages of the mechanism are: 1. Extension. 2. Descent. 3. Rotation. 4. Flexion. 5. Restitution (external rotation).

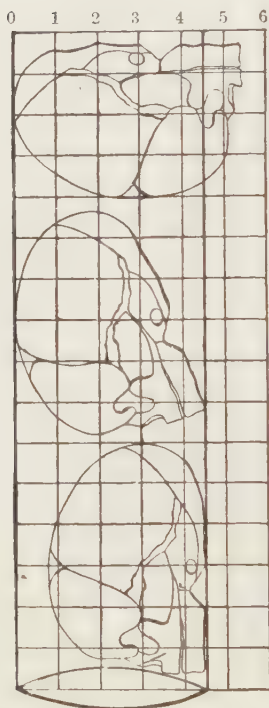
Mechanism of Left Mento-anterior Position (Chin to Left Acetabulum).—1. *Extension*, by which the occiput is tilted up and the chin down, so as to get the long ($5\frac{1}{2}$ inches) occipito-mental diameter more or less endwise to the plane of the pelvic brim. (See Fig. 121, page 304). The diameter of the child's face that agrees with the oblique diameter of the pelvis in which it engages, is the fronto-mental—*i. e.*, the chin is toward the left acetabulum, the forehead toward the right sacro-iliac synchondrosis.

2. *Descent* (simultaneously, however, with extension), by

which the head *descends*, chin first, through the brim, into the cavity, down to the inclined plane and pelvic floor.

3. *Rotation*, by which the chin glides along the left anterior inclined plane, at once, downward, forward, and inward toward

FIG. 121.



Influence of extension in permitting descent.

FIG. 122.



Anterior rotation of chin.

FIG. 123.



Delivery by flexion of chin over pubes.

the median line, to the symphysis pubis; the forehead meanwhile glides along the right posterior inclined plane to the centre of the sacrum. (See Fig. 122.)

4. *Flexion*, by which the chin escapes under the pubic arch, and rises up outside toward the mons veneris, while the fore-

head, parietal protuberances, and occiput successively emerge at the perineum (Fig. 123).

5. *Restitution*, by which the chin turns toward the mother's left thigh (the thigh corresponding to the acetabulum at which it originally presented), in consequence of shoulders rotating upon the inclined planes—left shoulder to pubes, right to coccyx.

Mechanism in Right Mento-anterior Position (Chin to the Right Acetabulum).—1. *Extension*. 2. *Descent*. 3. *Rotation* of chin, along right anterior inclined plane to symphysis pubis; of forehead along left posterior inclined plane to sacrum. 4. Flexion of chin upward, toward mons veneris, while occiput escapes at perineum. 5. *Restitution*, chin goes to right thigh (thigh corresponding to acetabulum at which it originally presented), by reason of shoulders rotating—right shoulder to pubes, left to sacrum.

Mechanism in Mento-posterior Positions.—Before describing these, we may anticipate the same differences with regard to rotation and flexion as we found in head presentations with regard to rotation and extension; that is to say, in the great majority of cases, when the chin is directed posteriorly, it rotates all the way round to the symphysis pubis. In doing so it of course passes the acetabulum, but it no sooner *reaches* the acetabulum than it is in reality an *anterior* position of the chin, and follows the same mechanism *exactly* as just described for mento-anterior positions. And again, with regard to flexion when the chin is being born, it would, in mento-posterior positions, of course, be flexed *downward* over the perineum, instead of *upward* toward the mons veneris.

It may here be anticipated, however, that such a mode of delivery in face presentations is practically a mechanical impossibility, as will be shown presently, and in which, therefore, the analogy between head and face presentations hitherto apparent, is wanting.

Mechanism in Left Mento-posterior Position (Chin to Left Sacro-iliac Synchronodrosis).—1. *Extension*. 2. *Descent*. 3. *Rotation*, in the *majority* of cases all the way round to the symphysis pubis (when the labor will be finished as in mento-anterior positions); in the *minority* of cases, rotation of the chin backward to the sacrum, *when the mechanism stops, and completion of delivery is mechanically impossible*, unless, indeed,

the head be unusually small and the pelvis unusually large, when delivery would take place by backward flexion of the chin down over the perineum. (See Fig. 126, page 307.)

FIG. 124.



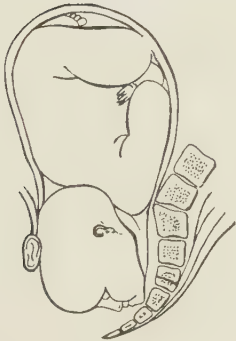
Diagrammatic view of mechanism in a right mento-posterior position of a face presentation, chin rotating to pubes. (SCHULTZE.)

Mechanism in Right Mento-posterior Position (Chin to Right Sacro-iliac Synchrondrosis).—1. *Extension.* 2. *Descent.* 3. *Rotation*, in the majority of cases all the way round to the pubes (and delivery as for mento-anterior positions); in the

minority of cases rotation of chin to sacrum, and consequent arrest of mechanism, further progress being impossible.

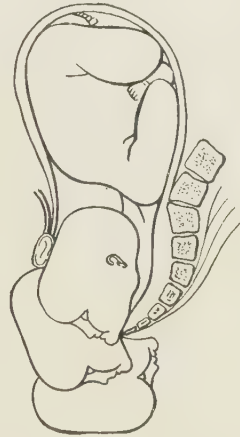
Explanation of Arrest, when Chin Rotates to Sacrum.—It is necessary for the chin end of the occipito-mental diameter *to escape over the edge of the perineum* before it can possibly execute the movement of downward flexion *outside* the perineum. Now, as we have seen, the depth of the *posterior* wall of the pelvis, from the sacral promontory to the tip of the coccyx, is four and a half inches, while *the length of the anterior surface of the child's neck, from the sternum to the*

FIG. 125.



Arrest of mechanism after
posterior rotation of chin.

FIG. 126.



Showing flexion, if neck were
long enough.

chin, is only about one inch and a half (only just long enough to span the depth of the *anterior* pelvic wall at the pubic symphysis); hence after posterior rotation of the chin, the child's sternum impinges upon the pelvic brim at the sacral promontory, or perhaps begins to descend a little below it, and there stops, so that the chin is thus arrested in the pelvis while it is yet a good distance higher up than the point of the coccyx, and the chin-pole of the occipito-mental diameter *cannot escape* over the perineal border to perform flexion. (See Fig. 125.)

If the neck were four or five inches long, as shown in Fig.

126, the chin *could* escape over the perineum and delivery take place by flexion downward and backward over the perineum, but such a length of neck is an impossible anatomical monstrosity.

Diagnosis of Face Presentation.—The *side* of the face (at the beginning of labor) is the part first touched by the examining finger—that is to say, in a L. M. A. position, the left malar bone; in a R. M. A. position, the right malar bone; in a L. M. P. position, the left malar bone; and in a R. M. P. position, the right malar bone. In passing the finger higher up, and more backward, the nose may be felt, the openings of the nostrils indicating the direction of the mouth and *chin*; while the orbits and forehead will be found in an opposite direction.

The face may be mistaken for a breech, owing to the swollen features resembling the genital organs. Diagnosticate by feeling the mouth, which is a fissure bounded by the *hard gums* of the maxillary bones, while the anus (to be felt in breech cases) is a soft elastic ring. No coccyx-point can be felt, as in breech cases.

Abdominal palpation in cases where vaginal examination is unsatisfactory, owing to the presenting part being high up and difficult to reach, may be useful and even necessary. The palpating finger recognizes the very round, large *prominence of the occiput on that side* of the pelvic brim (higher or lower according to degree of descent into excavation) toward which the *child's back* is directed; the head tumor appears *almost entirely absent* on the other side. In head presentation the *forehead*, directed toward the *child's abdomen*, was the most prominent and accessible region; difference very apparent. The breech is recognized by its usual characteristics in the fundus uteri, and while the palpating hand moves downward over the back toward the head, it *sinks into the deep depression or cavity* between the back and rounded pole of the extended occiput. The small irregular *projections of the extremities* over the *anterior* aspect of the child are more easily recognized than in head presentations, owing to the greater prominence of the abdomen caused by the child's body being bent *backward*, instead of being flexed forward as in head cases.

In some cases the horseshoe shape of the lower maxillary bone and chin may be felt on that side of the brim opposite the prominent occiput.

Diagnosis of the *positions* of a face presentation by palpation is made by noting whether the back and occiput are directed anteriorly or posteriorly, to the right or to the left.

Prognosis of Face Cases.—Swelling and discoloration of the child's face frequently occur (of which notice should be given before birth), but they pass away in a few days.

The child may die, if delivery be long delayed, from cerebral congestion due to pressure of its neck and jugular veins against the anterior pelvic wall; or its funis may be fatally compressed, after rupture of the bag of waters, between the *anterior projection* of the child's abdomen and the uterine wall.

Dangers to mother, such as may occur from any tedious labor, especially when in mento-posterior positions anterior rotation of chin fails to take place.

Though spontaneous delivery is the rule, the mortality to both mother and child is somewhat greater than in head presentations, and assistance is more frequently required.

Treatment of Face Cases.—In mento-*anterior* positions, generally none, further than carefully watching the case for symptoms of exhaustion from prolonged effort on the part of the mother, or of failure on the part of the child, when assistance may be rendered by forceps, provided the head have descended into the pelvic cavity. Use of forceps at the *superior strait* is not advisable in face cases; podalic version is preferable.

In all cases avoid rupturing membranes during examinations in early stage, and beware of injuring the eyes with the finger.

In mento-*posterior* positions, endeavor to secure anterior rotation of the chin when it fails to take place spontaneously. The several methods of attempting this are: 1. Press the forehead backward and upward during a pain, so as to make extension more complete, and thus cause the chin to dip lower down and touch the anterior inclined plane upon which it may glide forward. 2. Put a finger in the mouth, or on the outside of the lower jaw, and draw the chin forward during a pain. 3. Apply the straight forceps and twist the chin to the pubes. 4. Apply the vectis, or one blade of the forceps, *under* the most posterior cheek, and *over* the anterior inclined plane, thus, as it were, thickening the latter, so as to make it reach

the malar bone and constitute a *point d'appui* which the chin can touch and so glide forward.

Should these attempts to secure anterior rotation fail, an effort may be made with the hand, vectis, or fillet, to bring down the occiput and convert the face into a head presentation.

In order to succeed in this manœuvre the membranes should be unbroken, the os uteri dilated, the face not so deeply engaged that it cannot be lifted to or above the pelvic brim, and an anæsthetic administered.

Again, failing in this way to produce anterior rotation, the head, if it be *not* too deeply engaged in the pelvis, and have *not* passed through the os uteri, may be pushed back, and the child be delivered by *podalic version*.

Should none of these methods be practicable and the head become impacted in the pelvis with the chin toward the sacrum, the only resort is *craniotomy*. Attempts have been made in these cases to deliver by forceps after lateral incision of the perineum, but they can only succeed when either the child is small or the pelvis over-large. Usually the child's life has been so far imperilled by delay and its consequences that craniotomy may be done without compunction. Possibly symphyseotomy may prove useful in these cases in future.

In *all* cases of face presentation special care is necessary to avoid rupture of the perineum.

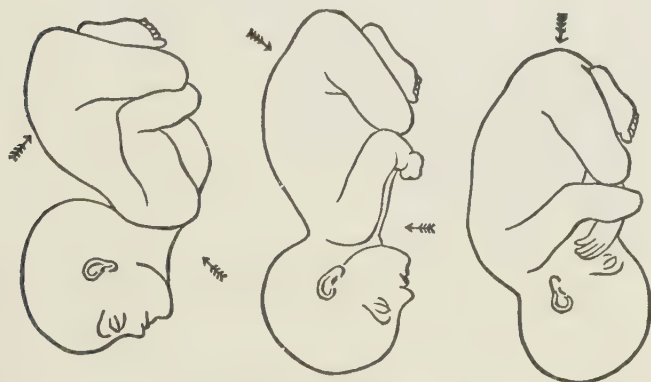
Correction of Face Presentation by External Manipulation.—*Early* rectification of face presentation—its conversion into an occipital one—by *external manipulation*, has been lately recommended. It is available only when membranes are unbroken, abdominal walls relaxed, and operator skilful. Let one hand over the abdomen seize the anterior shoulder and lift it, with the chest, upward and toward the child's back, while the other hand near the fundus presses the breech upward and toward the child's abdomen. When the body is thus lifted the occiput will descend, or may be assisted so to do by the hand of an assistant pressed upon it, low down, after which the breech is pushed *directly downward* and flexion rendered perfect.

The annexed illustrations, modified from Lusk's reproduction of Schatz's diagrams (see Fig. 127), explain the method more exactly. The arrows indicate the direction in which

pressure is applied to the several parts during successive steps of the operation. To understand this, note that in face presentations not only is the *head extended*, but the *spine and body* of the child are bent in such a way that the *sternum projects* in front, while the breech and occiput in a measure approach each other behind, as shown in the first of the three cuts in Fig. 126. All this must be corrected by pushing the projecting sternum back and the head and breech forward toward each other over the front of the child, thus securing normal flexion of the *body* as well as of the head.

Thus let one hand press externally upon the projecting sternum and shoulder of the child, pushing it toward the child's spine and somewhat upward toward the fundus uteri,

FIG. 127.



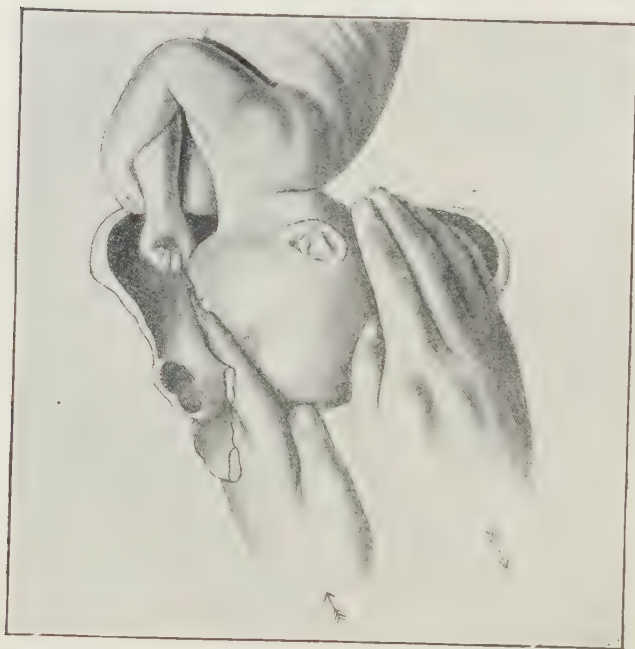
Schatz's method of rectification by external manipulation.

while the other hand presses the breech forward in the opposite direction. One of the hands may now be changed to press the occiput down and forward toward the anterior surface of the child's body, thus producing flexion and presentation of the occiput. Again, these manipulations can be carried on by *one operator externally*, while the fingers or hand of *another* assist in flexing the head by manipulating *per vaginam*, internally.

Some prefer the method of Baudelocque, by which the fin-

gers of one hand (in the vagina) press the lower jaw and chin *upward*, while the other hand on the abdomen presses the occiput *down*, as shown in Fig. 128. As flexion proceeds, the fingers inside press successively upon the upper jaw and finally upon the forehead, while the outside hand continues to press down the occiput.

FIG. 128.



Baudelocque's method of changing a face into a head presentation. Left hand in vagina, the right on the abdomen. (After JELLETT.)

Finally, let the young practitioner especially remember that the great majority of face cases will be delivered without assistance or interference, provided all other conditions be normal.

BROW PRESENTATION.

A rare presentation of the "brow" or forehead, intermediate between a head and a face, occurring once in about a thousand labors. It occurs in this way: Face presentations are deviations from head presentations; that is, in face presentations the head originally presented, but the occiput catching on the side of the brim, lodged there, while the chin was forced down, constituting face presentation; but in this process of conversion of a head into a face, arrest may take place half-way between the two, when, of course, the forehead will be made to appear and stop at the centre of the superior strait; this is a brow presentation. Most cases are *transient*; they change into a head or face. Those that do *not* change are "*persistent*," and lead to a very difficult or impossible delivery (the head and pelvis being of usual size), for the reason that the long occipito-mental diameter of the head ($5\frac{1}{2}$ in.), instead of being in line with the *axis* of the pelvic brim, is almost parallel with the *plane* of the brim, and therefore cannot descend through the superior strait, the longest diameter of which is only $4\frac{1}{2}$ or 5 in. (see Fig. 106, page 287).

Diagnosis.—The diagnosis may be made by vaginal touch revealing the large anterior fontanelle and its radiating sutures, the orbital ridges, eyes, and root of the nose. The mouth and chin are out of reach.

Treatment.—Treatment consists in converting the brow into either a head or face presentation by producing, respectively, complete flexion or complete extension, preferably the former, by pushing up the forehead and bringing down the occiput. In many cases it takes place spontaneously.

Manipulations for this purpose may be either external or internal or both conjointly, as just stated, for face presentations. Two fingers may be introduced into the child's mouth and traction made on the *superior* maxilla to produce extension and convert the brow into a face presentation.

When the brow presentation has been changed by manipulation into a head or face, but reverts to its old position, forceps may be employed to prevent this reversion, as well as to hasten delivery by traction.

In mento-posterior *positions* of a brow presentation, the same difficulties may occur when the case is changed into a face, as

in face presentation, hence every effort must be made to rotate the chin to the pubes.

Should the foregoing attempts to convert the case into a head or face fail, the next best method is podalic version.

When all other measures fail, craniotomy may become a last resort, and should certainly be an *early* one when the child is *dead*, for the mother's sake.

As in face cases, it is possible the future may demonstrate the utility of symphyseotomy in difficult brow presentations. Wallich has reported "seven operations with no maternal and only two foetal deaths" (Williams).

CHAPTER XVI.

BREECH, KNEE, AND FOOT PRESENTATIONS.

BREECH PRESENTATIONS.

These occur once in about fifty labors (2 per cent.). The pelvic end of the foetal ovoid presents, the lower limbs being flexed upon the abdomen, so that the buttocks first enter the the pelvic brim. Usually the legs are flexed upon the thighs, as shown in Figs. 129 to 134, exceptionally they are extended at full length, so that the feet approach the face or point over the shoulder. These last have been recently called *frank* breech presentations. (See Figs. 135 and 136, pp. 317 and 318.)

Positions of a Breech Presentation.—Of these there are *four*; and the given point on the breech, from which they are named, is the child's *sacrum*. Exceptionally the child's sacrum may be directly in front or behind, really making six positions. Thus :

1. Sacrum to left acetabulum (left sacro-anterior), L. S. A.—sacro-læva-anterior.

2. Sacrum to right acetabulum (right sacro-anterior), R. S. A.—sacro-dextra-anterior.

3. Sacrum to left sacro-iliac synchondrosis (left sacro-posterior), L. S. P.—sacro-læva-posterior.

4. Sacrum to right sacro-iliac synchondrosis (right sacro-posterior), R. S. P.—sacro-dextra-posterior.

The two *sacro-anterior* positions are most frequent.

Mechanism of Breech Cases.—In complete delivery of the child there are here three successive stages to be considered, viz. :

1. Mechanism of the breech.
2. Mechanism of the shoulders.
3. Mechanism of the head.

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FIG. 129.



R. S. A.

FIG. 130.



L. S. A.

FIG. 131.



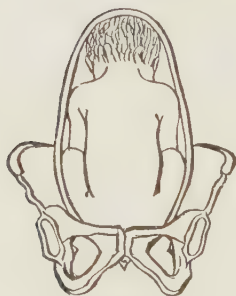
R. S. P.

FIG. 132.



L. S. P.

FIG. 133.



EXCEPTIONAL.

FIG. 134.



EXCEPTIONAL.

FIGS. 129-134.—Six positions of breech presentation.

Each of these may again be subdivided as follows :

- | | |
|-----------------------------------|--------------------------------------|
| <i>a.</i> Moulding, | <i>g.</i> Delivery of the shoulders. |
| <i>b.</i> Descent, | <i>h.</i> Flexion, |
| <i>c.</i> Rotation, and | <i>i.</i> Descent, |
| <i>d.</i> Delivery of the breech. | <i>j.</i> Rotation, and |
| <i>e.</i> Descent, | <i>k.</i> Delivery of the head. |
| <i>f.</i> Rotation, and | |

FIG. 135.



Breech presentation ; legs extended.

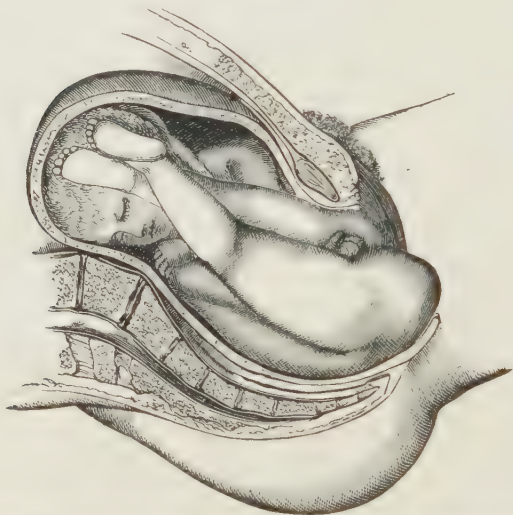
Mechanism in Left Sacro-anterior Position (Sacrum to Left Acetabulum).—Here the longest diameter of the breech, viz., from one trochanter to the other, occupies that oblique diameter of the brim which extends from the *right* acetabulum to the *left* sacro-iliac synchondrosis. The sacrum of the child being directed toward the left acetabulum, its back, and of course the back of its head (occiput) are directed toward the left anterior part of the uterus, in a line with the left acetabulum ; hence, when the body is delivered, the

occiput of the after-coming head will also be directed to the left acetabulum. As labor progresses there occur :

1. *Moulding* of the breech, by which it simply becomes gradually compressed ("moulded") into a circular shape, so that it may pass through the os uteri and pelvic brim.

2. *Descent*.—The breech passing down the pelvic cavity to the pelvic floor.

FIG. 136.



Rotation and delivery of hips. This figure represents the legs *extended*, which is unusual.

3. *Rotation*.—The left hip (the hip nearest the pubes) glides along the right anterior inclined plane to the pubic symphysis; while the right hip (the hip nearest the sacrum) glides along the left posterior inclined plane to the sacrum. The long (bitrochanteric) diameter of the breech, which entered the brim in the oblique pelvic diameter, has now, therefore become parallel with the longest (antero-posterior) diameter of the inferior strait. (See Fig. 136.)

4. *Delivery* of the breech—the hip that is toward the pubes fixing itself against the arch, while the other one sweeps round

the curve of the (maternal) sacrum and comes out first at the perineum.

It should again be observed that *descent* necessarily occurs *simultaneously* with and during all the other stages. So the shoulders and head have, of course, been simultaneously descending with the breech. Descent is considered as a separate stage only in so far as it is a necessary preliminary of rotation—i. e., the descending part *must come down* low enough to strike the *inclined planes* and pelvic floor before rotation can occur.

FIG. 137.



Rotation of shoulders; their long (bisacromial) diameter in line with long (antero-posterior) diameter of outlet.

Note further that when the breech is extruded the child's body has necessarily become bent *on its side* conforming to the curve of the pelvic canal. Sometimes this is improperly set down as a separate stage of mechanism, called "lateral flexion."

To resume, the breech having been delivered, we have next to deal with the shoulders, thus :

5. *Descent*.—The longest (bisacromial) diameter, entering the brim at the same oblique diameter as the bitrochanteric diameter of the breech did, descends to the pelvic floor.

6. *Rotation*.—The shoulder nearest the pubes (left one) rotates to the pubes ; the shoulder nearest the sacrum (right one) rotates to the sacrum (see Fig. 137), which brings the bisacromial diameter antero-posterior at the inferior strait.

FIG. 138.



Delivery of lower shoulder first, at the perineum. (In Fig. 137 occiput is to the left ; *right* shoulder will come first at the perineum. In Fig. 138 occiput is to the right, and *left* shoulder comes out first at the perineum.)

7. *Delivery of the shoulders*—the one toward the pubes fixing itself there, while the other one sweeps round the curve of the sacrum, and comes out first at the perineum. (See Fig. 138.)

The shoulders having been delivered, next comes the head, thus :

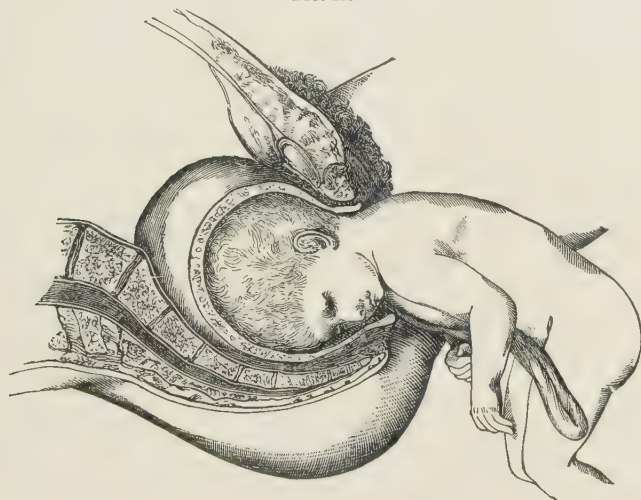
8. *Flexion*, by which the chin-pole of the occipito-mental diameter is made to dip down toward the child's sternum, while the occipital pole is tilted up toward the fundus uteri, thus placing the occipito-mental diameter more or less endwise and parallel with the axis of the pelvis. The occiput is toward the left acetabulum and the forehead toward the right sacro-iliac synchondrosis ; hence the occipito-frontal diameter occupies an oblique diameter at the brim.

9. *Descent* of the head into the pelvic cavity, until occiput strikes left anterior inclined plane.

10. *Rotation*—of occiput to pubes—of forehead and face to hollow of sacrum, thus bringing longest engaging diameter of head antero-posterior at the outlet. (See Fig. 139.)

11. *Delivery of head*—the occiput fixing itself *behind* the pubic *symphysis*, the back of the child's neck *under* the pubic *arch*, while the chin escapes first at perineum, followed successively by mouth, nose, forehead, biparietal equator, and last of all the occiput itself, which sweeps along the curve of sacrum.

FIG. 139.



Anterior rotation of occiput.

Mechanism in Right Sacro-anterior Position (Sacrum to Right Acetabulum).—*Moulding, descent, and rotation* of the breech. The hip nearest the pubes rotating to the pubes, the one nearest the sacrum to the sacrum. *Delivery* of the breech—the hip nearest the sacrum coming out first at the perineum.

Descent and rotation of the shoulders—the shoulder nearest the pubes rotating to the pubes, the one nearest the sacrum to the sacrum. *Delivery* of the shoulders—the one at the sacrum coming out first over the perineum.

Flexion, descent, and rotation of the head—the occiput (now at the right acetabulum) rotating on the right anterior inclined plane to the pubes, the forehead to the sacrum. *Delivery of the head*—chin, mouth, nose, forehead, biparietal equator, and lastly occiput, successively escaping over perineum.

Mechanism in Left Sacro-posterior Position (Sacrum to Left Sacro-iliac Synchrondrosis).—Moulding, descent, rotation, and delivery of the breech; and descent, rotation, and delivery of the shoulders exactly as already described for *anterior* positions of the sacrum.

Flexion and descent of the head are also the same, *except* that the occiput enters the pelvis directed toward the left sacro-iliac synchrondrosis instead of toward one of the acetabula.

FIG. 140.



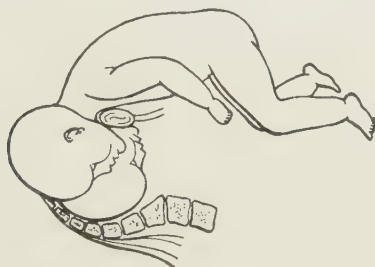
Posterior rotation of occiput and delivery by flexion.

Hence *rotation* of the occiput takes place, *in the majority of cases*, all the way round to the symphysis pubis, when the rest of the mechanism is the same as just described for *anterior* positions of the occiput. *In the minority of cases* the occiput rotates posteriorly into the hollow of the sacrum, the forehead to the pubes.

Delivery of the head now takes place (most often) by *continued flexion*, the chin-pole of the occipito-mental diameter dips toward the child's sternum (*under* the pubic arch), while the occiput is tilted up posteriorly toward the sacral promontory. The nape of the child's neck rests on the perineum, while chin, mouth, nose, forehead, biparietal equator, and lastly occiput, successively escape *under* the pubic arch. (See Fig. 140.) During delivery, the body should be held downward toward the floor; if held up, it is plain the sternum would be brought against the chin and thus *prevent* delivery

taking place. Delivery of the head may also take place (but very rarely) by *continued extension*. Thus, the chin-pole of the occipito-mental diameter, instead of being depressed *under* the pubic arch, points up *above* the pubic symphysis—in fact, toward the woman's bladder. The *anterior* surface of the child's neck is fixed against the *posterior* aspect of the symphysis pubis, while the occipital pole of the occipito-mental diameter is forced down along the hollow of the sacrum to the coccyx, and escapes first at the perineum, followed successively by biparietal equator, forehead, nose, mouth, and, last of all, the chin itself. (See Fig. 141.) The body is to be held up toward the pubes.

FIG. 141.



Posterior rotation of occiput and delivery by extension.

Mechanism in Right Sacro-posterior Position (Sacrum to Right Sacro-iliac Synchondrosis).—The first parts of the labor are the same as just described for the *left* sacro-posterior position. When the breech and shoulders are delivered, the occiput is, of course, directed to the right sacro-iliac synchondrosis. In the majority of cases it rotates all the way round to the pubes, and so becomes an anterior position. In the minority of cases it rotates to the sacrum, and will then be delivered either by *continued flexion*, the *chin* escaping first under the pubic arch, or by *continued extension*, the *occiput* escaping first at the perineum, as just described for the L. S. P. position. Cases in which posterior rotation of the after-coming head occurs comprise a very *small* minority; such rotation is extremely rare, and will seldom be seen in ordinary practice.

Sometimes in *sacro-posterior* positions of the breech, the rotation which brings the anterior hip to the pubes *goes on further*, so as to bring the child's *back* to the pubes, or the back comes to the pubes by continuation of the shoulder rotation. In this way the occiput is brought in front to the acetabulum before its descent to the pelvic floor. It has become occipito-anterior.

Causes.—Hydrocephalic enlargement of the cranium; pelvic narrowing; placenta prævia; polyhydramnios; small size of the child, or its being dead; multiple pregnancy; premature delivery; uterine tumors interfering with usual attitude of child. Breech presentation may occur repeatedly in the same woman, as might be expected in cases of pelvic narrowing, or in those with uteri deformed by tumors.

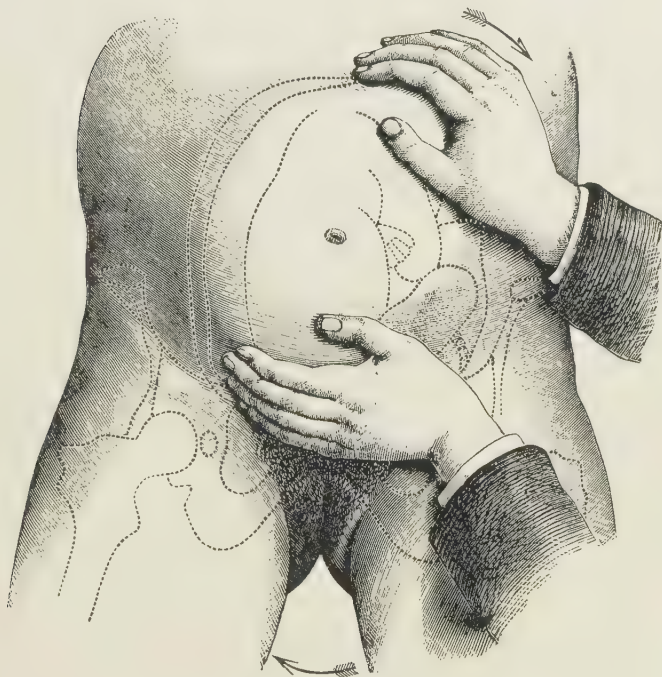
Diagnosis of the Breech.—The examining finger *first* touches the *side* of the anterior buttock (the one directed toward the pubes), and feels the trochanter covered by muscles, etc., which makes it softer than the hard globe of a head presentation. The fissure between the nates, the genital organs, the anus, the probable presence of meconium (thick and undiluted with liquor amnii), the tip of the coccyx, and spinous process of sacrum, are sufficiently characteristic. Scrotum in males sometimes swollen and oedematous, resembling polypus or tumor, but is less solid. Difficulty in early stage, owing to height of presenting part. Bag of waters may be large or protrude as elongated sac. Beware of mistaking fetal vulva for axilla, and fat fold of elbow for fissure of nates.¹ Elbow has three bony projections (olecranon and two humeral condyles). Diagnosis from face (see Face Cases, p. 308). Diagnosis of the "*position*" of a breech "*presentation*" may be determined by the direction of the fissure between the nates and by the tip of the coccyx, which always points forward toward the pubes of the child.

When the presenting part is too high up to be touched satisfactorily *per vaginam*—as will often happen early in labor, or before its beginning—diagnosis may be made by abdominal *palpation*. Early in labor the breech will be at or above the pelvic brim; it *never descends at this time*, as the head sometimes does; hence palpating finger-ends, entering

¹ Owing to the attitude of the child, and the undeveloped condition of its gluteal muscles, there is really little or *no fissure* between the nates.

the brim behind pubic rami, find *excavation empty*. Tumor of breech (not often central, but usually more toward one or other iliac fossa) feels *softer, more irregular, and more voluminous* than globe of head. Resisting plane of back is *continuous* with breech from below, while above, the fingers sink into elastic depression between trunk and head. Head discovered

FIG. 142.



Diagnosis of pelvic presentation by palpation. (After PARVIN.)

in fundus uteri usually more on that side opposite to the iliac fossa toward which the breech lies. Head may be concealed under liver or behind false ribs, and hence difficult to palpate, especially in primiparæ, in whom the child is apt to lie more vertically (less oblique) than in multiparæ. Head may be *made more palpable* by pressing breech more toward

the iliac fossa, which brings the head more within reach on the opposite side of the fundus. (See Fig. 142.)

In following resisting plane of back it will be found to curve over above the umbilicus toward the side where the head lies. The latter may sometimes be made to move by *ballotement*. In *sacro-posterior* positions the breech tumor will *nearly always* be accompanied by the movable *small parts*. In *sacro-anterior* positions the breech will *rarely* be accompanied by small parts. The small parts and intervening elastic spaces filled with liquor amnii will usually be found on the side of the uterus opposite the child's back. In *sacro-posterior* positions the *lateral* aspect of the child's trunk will be more easily recognized than the back itself. (See Figs. 129-132 in which, however, the child's body should have been placed *more obliquely*—the breech more over the iliac fossa, the head further toward the opposite side.)

Prognosis of Breech Cases.—(Generally favorable to mother, though labor may be long; but dangerous to child. When body is delivered and head retained, child dies from *suffocation* due to pressure on umbilical cord or to partial separation or compression of placenta. Danger greater in footling than breech case, because small feet do not dilate os uteri sufficiently to permit easy passage of after-coming head, hence delay is longer after expulsion of body than occurs in breech cases. Liability to prolapse of funis. In cases where legs are extended along front of child, labor may be long and difficult. The limbs act like splints, preventing that *lateral* flexion of the body by which the latter is conformed to the curve of the axis of the pelvic canal. In difficult cases, child liable to injury from manipulations during delivery, hence fracture or dislocation of humerus and femur; injury to spinal column or spinal cord by traction on trunk; temporary paralysis from pressure on brachial plexus; hemorrhage into muscles and cellular tissue of neck, especially hæmatoma of sterno-mastoid muscle.

Treatment of Breech Cases.—Do nothing until the birth of the breech.¹ Preserve membranes from rupture. Refrain from attempting to hasten matters by drawing down the feet. It produces displacement of the arms above the head, and

¹ It has been recently recommended to perform cephalic version by external manipulation early, before rupture of membranes, to avert subsequent danger to child.

also extension of the occiput. Delay during early stages of labor is *not dangerous*, but prepares the parts, by prolonged dilatation, for subsequent easy passage of after-coming head. Delay of latter *is fatal* to child.

When the breech is born, promote lateral flexion of body by pressure on perineum. When trunk is delivered, receive, support, and wrap it in warm cloth. Gently pull down a loop of the cord, and place it toward that part of the pelvis where it will be less liable to pressure, viz., toward that sacro-iliac synchondrosis to which the child's abdomen is directed; but waste no time in doing this. Feel pulsations in cord; their feebleness proclaims danger to child. Hold the body in such a manner as not to impede rotation of shoulders into antero-posterior diameter of outlet. When shoulders are born, direct back of child to pubic symphysis, thus promoting anterior rotation of occiput. During birth of head lift body toward mons veneris.¹

In the *rare* cases where *rapid spontaneous* delivery of the head follows extrusion of trunk, no further active interference is necessary.

But *rapid spontaneous* delivery of after-coming head is exceptional. Delay is fatal; judicious assistance harmless. If the shoulders be not readily extruded, first one (that at perineum) and then the other must be drawn out by the finger hooked over the elbow or acromion process of the shoulder, *elevating* the breech while withdrawing the *posterior* shoulder—*depressing* it toward the perineum while getting out the *pubic* one. For various methods in delivering the arms in different cases, see Chapter XIX., on "*Version*."

The means for rapid delivery of head when it has *descended to the inferior strait*, and occiput has rotated to the pubes, are: Ergot (hypodermically if the case be urgent); manual pressure of fundus uteri through the abdomen by a skilled assistant previously secured; urging the woman to bear down during the pains with all the voluntary effort she can command; and traction judiciously applied thus: Support body

¹ An ignorant savage woman of the woods, finding the body of her child extruded, would (it may be presumed), in a mingled spirit of affection and investigation, *lift the body upward over her own abdomen*, thus causing *pressure on the fundus uteri*, and *making traction* in a way to promote delivery of the head. Hence it is interesting to observe that the methods of science have unconsciously followed the teaching of Nature's school to the untutored savage—a seal of sanction not to be disdained.

in left hand, one or two fingers of which may be passed in along posterior vaginal wall to child's mouth or to upper jaw-bone, one finger being on each side of the nose, and its chin depressed toward its chest, while two fingers of the right hand are passed in under pubic arch and pressed upon the occiput so as to tilt it up and *assist flexion*. (See Fig. 143. Thus, during traction, the chin-pole of occipito-mental diameter is made to escape over perineum, and delivery follows. The finger (or two of them) of left hand may also be passed into rectum and made to press through the recto-vaginal wall upon the forehead or malar bones, thus again promoting *flexion*.

FIG. 143.



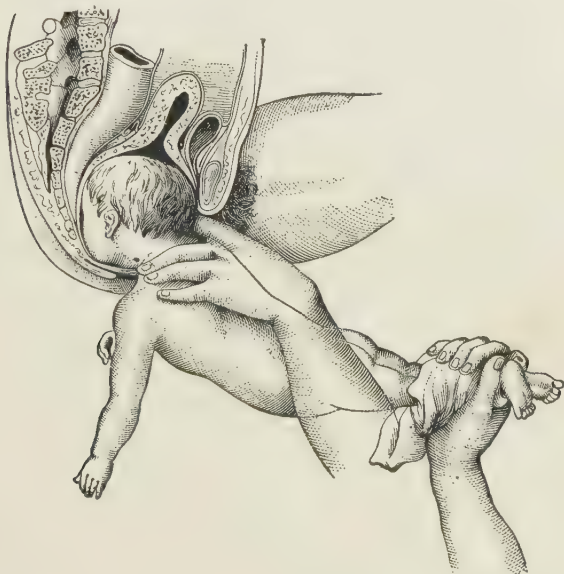
Extraction of head in breech cases.

Another Method. Seize the feet with the right hand, and hook the left hand over the back of the neck (Fig. 144). Traction on the legs is now made in a direction *almost at right angles to the pubes*, so that the resistance of pubic bones impinging against occiput pushes it up, while chin and face flex and descend along sacrum, escaping at perineum. The

left hand steadies the head, prevents its too sudden escape, and also assists the right in making traction. The hand of an assistant, pressing upon fundus uteri, will expedite the process, as in the first method described.

In cases of *sacro-posterior* positions where anterior rotation of occiput has failed to occur, depress the body toward perineum, pass one or two fingers under pubes to that temple or side of the face directed anteriorly, and press it round toward the sacrum. Face cannot be forced round to sacrum by *twisting body* without danger to child's neck.

FIG. 144.



Manual extraction of after-coming head. (From GALABIN.)

Should this proceeding fail, and the occiput *still remain posterior*, the head must be delivered in one of two ways, viz.: If the head be *flexed* with the chin *below* the pubic arch, traction must be made directly *downward*; that is to say, the woman being upon her back, with her hips over the edge of the bed, make traction on the body vertically *down*

toward the floor; aid this by suprapubic external pressure, and one or two fingers may be passed into rectum, pushing *up* the occipital pole, while external hand presses *down* the forehead, thus securing *complete flexion*—the proper mechanism for delivery. (See Fig. 140, page 322.)

FIG. 145.



Arrest of head at superior strait; method of delivery. (WINCKEL.)

The other way is by *extension*. Now the chin is *above* instead of below pubes. Traction on body must be made vertically *upward*—toward the ceiling instead of the floor—while the hand on abdomen makes pressure downward and backward upon the chin. One or two fingers passed far into the rectum may assist extension and extraction by pressing occiput forward toward pubes. (See Fig. 141.)

When manual delivery fails, forceps may be applied to the after-coming head. (See Chapter XVIII.)

Extraction when After-coming Head is at Superior Strait.—Pressure on the fundus uteri from above, and traction on the

feet and shoulders in line with *axis of plane of superior strait*, may first be tried. - When the woman is on her back and brought to the edge of the bed, the traction should be almost directly downward toward the coccyx; and the manual pressure on the abdomen from above should be chiefly on the

FIG. 146.

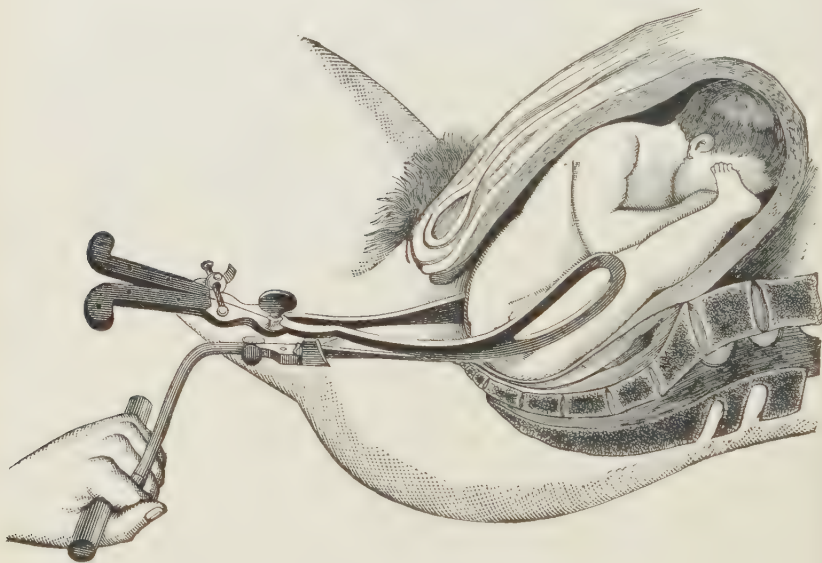


Traction in after-coming head arrested high up.

frontal pole of the head to secure flexion. When an assistant is present to make abdominal pressure, the obstetrician may draw on the shoulders with one hand, while two fingers of the other are passed up into the child's mouth and traction

made on the jaw. Thus three expedients act simultaneously, viz. ; *abdominal pressure*, *shoulder traction*, and *jaw traction*. (See Fig. 145.) Should these fail, forceps may be used to bring the head into the pelvic cavity. Forceps are also advisable when the head is detained by a resisting os or cervix uteri, but great care is necessary to avoid laceration of cervix. In these cases Barnes recommends backward traction by the

FIG. 147.



Tarnier's forceps applied to the thighs. (OLLIVIER, LUSK.)

feet and upon the nape of the neck by encircling the latter with a fine napkin or silk handkerchief, as shown in Fig. 146. In any case where delivery of after-coming head is delayed, and weakness of umbilical pulse with spasmodic contraction of child's respiratory muscles indicates impending suffocation, we may enable the child to breathe before birth by passing in two fingers between the face and vaginal wall, thus making

a channel for air to the mouth or nostrils, or a large catheter may be passed into the mouth. In one case life was saved by *tracheotomy* before delivery.

In all cases of breech presentation every means necessary for the restoration of suspended animation in the infant should be provided beforehand.

FIG. 148.



The fillet in dorso-anterior position. (Lusk.)

In cases of *unusual* delay during *early* stages, *accompanied* by *symptoms of exhaustion*, and due to a large breech, small pelvis, or some other abnormality, a finger, blunt-hook, or fillet may be passed over the groin and used for traction, the traction being directed toward the child's sacrum rather than toward its thigh, thus lessening danger of fracturing the femur.

If possible to reach a foot, it may be pulled down. Forceps and the vectis have been employed; their use is questionable.

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They may be tried, however, before embryotomy, which may, very rarely, become a last resort in bad cases of impaction.

Occasionally, owing to obliquity of the uterus, the breech, as it were, *sits on the edge of the pelvic brim*, instead of presenting over its centre. Progress is impossible. *Treatment:* Relieve by manual pressure over abdomen, or put a hand in the vagina and lift the breech off the side into the middle of the brim. Combine both manipulations.

FIG. 149.



Method of bringing down the foot. (From PARVIN, after FARABŒUF and VARNIER.)

Treatment when Legs are Extended.—These are exceptional cases, and often occasion difficulty and danger. Should the diagnosis have been made early, before the breech has descended below brim of pelvis, and before the bag of waters

has been discharged and the womb contracted round the child, cephalic *version*, by *external manipulation*, is best. This early diagnosis is difficult, and usually not attempted soon enough. It can scarcely be reached except by mapping out the child by palpation over the abdomen. Failing to bring down the head thus early, by external manipulation, the next expedient

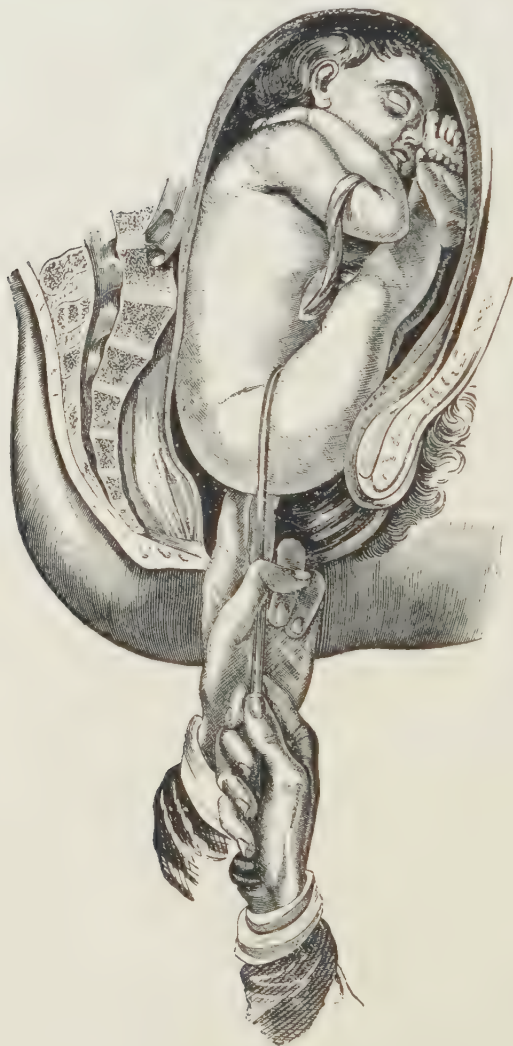
FIG. 150.



Traction by fingers hooked in groin. (JEWETT, after A. R. SIMPSON.)

is to pass the hand inside, all the way to *fundus uteri*, and bring down the feet—a mode of proceeding at best difficult, and endangering rupture of uterus, especially after waters have been evacuated. A better method is to pass in two fingers until they reach the popliteal space of the thigh (preferably the anterior thigh), and then press the limb outward and backward, which at once flexes the leg and brings the foot

FIG. 151.



Blunt-hook applied in breech presentation. (PARVIN.)

within reach, when it can be caught and drawn down. (See Fig. 149.)

When breech has descended into pelvic cavity or become impacted, version should be abandoned. The expedients now at our disposal, named in order of preference, are *forceps*, *fillet*, *blunt-hook*, *cephalotribe*. Experience has amply demonstrated that forceps (made for the head) may be also safely applied to the breech when it has engaged in the pelvic cavity, and the os uteri is dilated. When hips have rotated (one to os anum and one to pubes) one blade of forceps is applied to sacrum of child, the other to *posterior* surface of child's thighs. When hips have *not* rotated, but remain transverse, the blades are applied to the *lateral surface* of the *thighs* (see Fig. 147, page 332) not over the trochanters, thus avoiding injurious pressure upon iliac crests. Traction only during pains, slowly and without great force, assisted by pressure of hands of assistant over fundus uteri through abdomen. Should forceps fail, or breech be too high up to admit of their application, and version be impracticable without using dangerous force, pass *fillet* over groin, in preference round the thigh directed anteriorly, and make traction (see Fig. 148, page 333) until breech is low enough for forceps, or for fingers to be hooked in groin (see Fig. 150); or the whole hand may be passed into the vagina and be made to grasp breech bodily, a thumb in one groin and fingers over opposite trochanter. The *blunt-hook*, properly guarded, may be of service, passed over groin for traction. (See Fig. 151.) It requires skill and caution to prevent injury to child as well as mother. In impaction cases, where all these methods prove to be unavailing, *symphyseotomy* should be done if the child be alive. When child is dead, or other measures have failed, use *cephalotribe*, applying it tightly to breech, and extract during pains by judicious traction.

KNEE AND FOOTLING CASES.

These do not require separate study. The feet and knees are small enough to pass through the pelvis without any special mechanism. The breech and other parts following undergo the same movements as in original breech cases.

Diagnosis of Knee.—Chiefly by exclusion. By its large size; by the tibial spine and patella. From a shoulder by

the absence of ribs and intercostal spaces, etc. From an elbow by the *flat* patella—very different from the *pointed* olecranon.

Diagnosis of Foot.—By the projecting heel. From a hand by the fingers being longer than the toes. The great toe is longer than the others—the thumb shorter than the fingers. The fingers can be easily separated; the toes cannot. The foot is placed at right angles to the leg; the hand is in a line with the arm. The foot is thicker and not so flat as the hand. Its inner border thicker than its outer one—not so the hand. When, before rupture of the membranes, the foot is touched by the obstetrician's finger, it will usually be drawn up with a quick, jerking movement, while the hand, under like circumstances, will move away slowly, if at all, or if the membranes be ruptured, grasp the examining finger.

Treatment of Knee and Footling Cases.—The management of these cases is practically the same as in breech presentation. So is the mechanism. Most cases *were* breech presentations originally, the presenting foot having been displaced downward toward the os uteri, either by the active motions of the child or by a gush of liquor amnii when the waters broke, or by some other process. Rarely labor *begins* with the heels placed against the buttocks, the lower extremities having the same relation to the body as is observed in a kneeling posture. Footling cases are often more tedious than when the breech presents; the small and irregular-shaped feet (or knees) do not so well adapt themselves to the shape of the os uteri, hence dilatation of the latter is slow and labor painful. There is more danger to the child during delivery of the after-coming head, for the feet, hips, and body come through the os uteri without producing sufficient dilatation of the os to admit the head afterward.

Whether one or both feet present, and whether at the os uteri or at the os vaginae, either before or after rupture of the membranes, the *best rule of treatment* (in the absence of any complication) is to leave the case alone—taking special care *not* to rupture the bag of waters—until the hips are delivered, when active interference may be necessary, as described in the management of breech cases, to prevent fatal delay with after-coming head. (See pp. 326 and 327.)

Occasionally, unusual and serious delay may occur when

the presenting parts are at the superior strait, owing to a foot or a knee being caught over the edge of the pelvic brim, preventing descent. The obstructing limb should be placed right, or hooked down with the finger. Since in doing this there is a risk of rupturing the membranes (be they still unbroken), try frequent changes in the woman's posture; this alone will sometimes remedy the difficulty.

Complex presentations, of a foot alongside of the head or face; or of a foot and hand; or of a foot and a hand with the head or face, etc., may require interference. When the head or face presents, try to push back the accompanying hand or foot. Failing in this, the foot may be held down by a fillet while the head (or face) is pushed up and version performed, converting the case into a pelvic presentation. Should this be impossible, the head (or face) may be extracted by forceps, while the offending limb remains down. Should all fail, craniotomy may be necessary.

When hand and foot present alone—*i. e.*, without the head or face—pull down the foot and push up the arm—really podalic version, as in arm presentation.

The method of *extracting* the hips, body, and arms of the child in any case of breech or footling presentation, where some emergency renders such artificial extraction necessary, is described in Chapter XIX., on Version (page 377).

CHAPTER XVII.

TRANSVERSE PRESENTATIONS.

ANY presentation in which the child's body lies transversely *across* the pelvis, instead of *endwise*, is a "transverse presentation"; hence presentations of the arm, shoulder, elbow, side, back, abdomen, etc., are all included in this class. Sometimes called "trunk" and "cross" presentations. They occur once in about two hundred and fifty labors.

For practical purposes it is only necessary to study *two* transverse presentations, viz.:

1. *Right lateral presentation* (including right arm, shoulder, elbow, hand, etc.).

2. *Left lateral presentation* (including left arm, shoulder, etc.).

Each of these two *presentations* has two "positions," viz.:

1. *Right cephalo-iliac* (the head, or "cephalic" end of the child, resting upon the *right* ilium).

2. *Left cephalo-iliac* (the "cephalic" end of the child resting upon the *left* ilium).

Since in the *right cephalo-iliac* "position" of a *right lateral* "presentation" (Fig. 153), and in the *left cephalo-iliac* "position" of a *left lateral* "presentation" (Fig. 155) the back (*dorsum*) of the child is directed toward the *posterior* wall of the pelvis, these two positions have also been called "*dorso-posterior*" ones; while the other two positions, in which the *dorsum* of the child is directed toward the pubes (Figs. 152 and 154), are called *dorso-anterior*.

Presentations of the *abdomen* and *back* are very rare, and soon become changed, *spontaneously*, into *lateral* presentations, or they *must* be so changed *artificially*.

In cross presentations the child is seldom or never *exactly transverse*, but obliquely placed; the *head* is *usually* lower than the breech, as shown in the figures, hence they are sometimes called "*oblique*" presentations.

Mechanism of Transverse Presentations.—There is *no* mechanism; at least for *practical purposes* it may be considered that natural delivery in cross presentations is *mechanically impossible*.

FIG. 152.



FIG. 153.



Left cephalo-iliac (or dorso-anterior) position of *right* shoulder. Right cephalo-iliac (or dorso-posterior) position of *right* shoulder.

Actually, however (so wonderful are Nature's resources), there are *two* processes by which, in *exceptional* cases, delivery

FIG. 154.



FIG. 155.



Right cephalo-iliac (or dorso-anterior) position of *left* shoulder. Left cephalo-iliac (or dorso-posterior) position of *left* shoulder.

may occur spontaneously; but they are neither sufficiently safe nor frequent to be relied upon or waited for in practice. These are "*spontaneous version*" and "*spontaneous evolution*."

Spontaneous Version. That end of the fetal ovoid nearest the pelvic brim (one end generally *is* so, for the child's body lies *obliquely* across the pelvis, seldom *exactly* transverse), under the influence of uterine contraction, gets lower and lower, and the other end higher and higher, until

FIG 156.



Chiara's frozen section, representing arrested spontaneous evolution.

finally the lower end slips over the edge of the brim into the pelvic cavity, and the presentation has then become longitudinal, either a head or breech. This process is most apt to occur in multiparous women, with feeble uterine contrac-

tion, and *before* rupture of the membranes; it is sometimes called "*spontaneous rectification*," those who use this term reserving the expression "*spontaneous version*" for cases in which that part of the child directed toward the fundus is turned downward to the pelvic brim. This latter proceeding occurs most frequently *after* rupture of the membranes in women with powerful contractions of the uterus. In this the os uteri is spasmodically contracted, so that while no downward progress

FIG. 157.



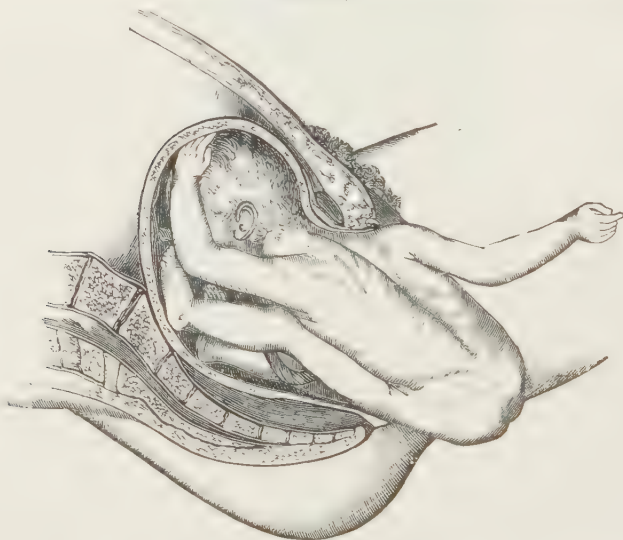
Spontaneous evolution (first stage).

of that end of the foetal ovoid nearest the brim can take place (it on the contrary glides laterally and upward), that end of the child *nearest the fundus* is forced all the way down to the pelvic brim, and a head or breech presentation results.

While spontaneous rectification and version are usually ascribed to uterine contraction, it is probable that they are promoted by antero-lateral pressure of the woman's thighs upon the abdomen, when she assumes a sitting, kneeling, or squatting posture.

Spontaneous Evolution.—The child's body remains cross-wise to the pelvic brim. The head rotates (*above* the brim) toward the nearest acetabulum, the breech toward the opposite sacro-iliac synchondrosis. The arm is extended from the vagina, the shoulder descends into the pelvic cavity, the neck rests behind the symphysis pubis. The body is then doubled laterally on itself, breech and head approaching each other (just as one might press together the two ends of a sausage), while the rounded, convex angle of duplication is forced down

FIG. 158.



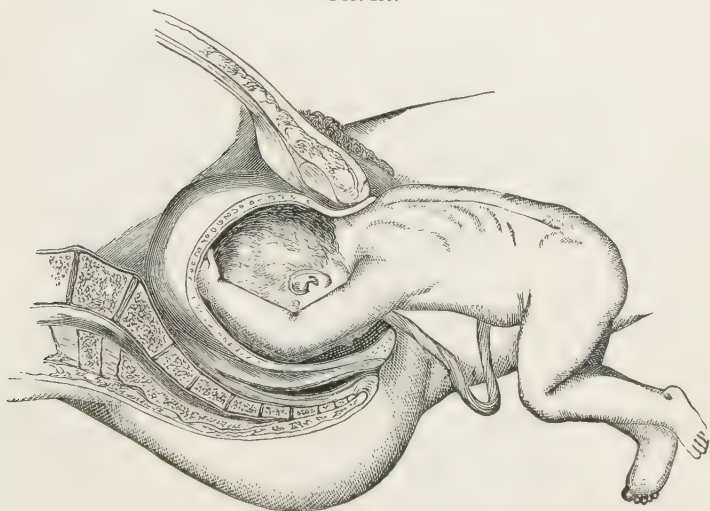
Spontaneous evolution (second stage).

through the pelvic cavity to the inferior strait. The side of the child (the side of its *chest*) is born first, followed by breech, legs, and feet, which are successively forced down along the sacrum and emerge at the perineum. Unless the pelvis be large, the child small, and uterine contraction strong, fetal impaction is apt to occur, or the child is born dead from the prolonged and violent compression to which it has been subjected. (See Fig. 156, page 342, representing a case as exhibited by frozen section of cadaver, after Barnes.)

When the process is successful, its several stages are those shown in Figs. 157, 158, and 159.

Very rarely a process of spontaneous evolution (different from that just described) occurs in which the child is *delivered* with *doubled body*—"evolutio conduplicato corpore." Instead of remaining above the brim, the *head enters the pelvis with the body*, into which it is deeply pressed, so that head and abdomen come together, followed successively by breech and legs. The second arm lies between the head and breech. In

FIG. 159.



Spontaneous evolution (third stage).

the other more common mode of evolution, the body was *undoubled* during delivery, body coming first, head afterward; in the rare form, body and head *remain doubled* and come together. (See Fig. 160.) This last only occurs with premature or macerated infants, or abortion cases. Delivery is hastened by traction on the arm.

Causes of Transverse Presentation.—Prematurity of the labor. Placenta prævia. Narrowness of pelvic brim, great lateral obliquity of the uterus. Multiple pregnancies. Undue

mobility of the child from excess of liquor amnii. Accidental pressure externally from blows, falls, dress, etc. Repeated occurrence of cross-births in the same woman is probably due to a narrow pelvic brim.

FIG. 160.

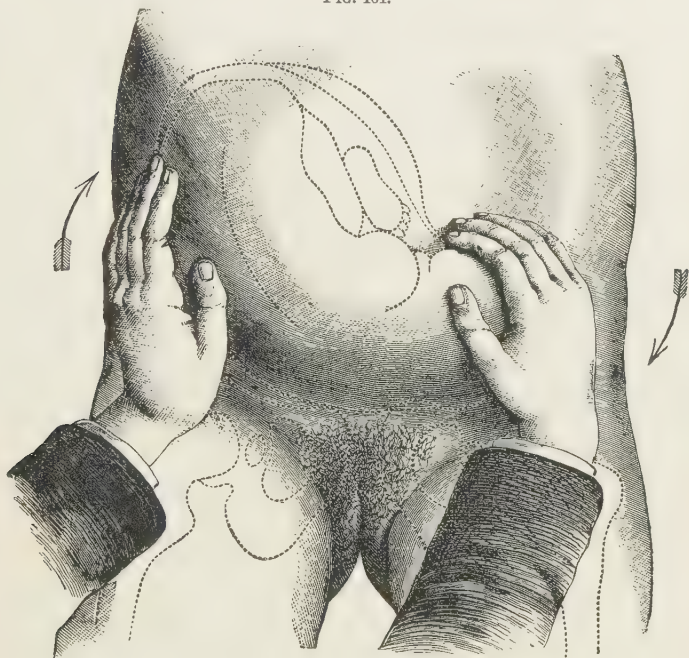


Birth of doubled child. *Evolutio conduplicato corpore.* (KLEINWACHTER.)

Diagnosis of Transverse Cases.—By external palpation and inspection the womb is found to be unsymmetrical in

shape, and longer transversely or obliquely than vertically. Since in the *large majority* of cases the back of the child is *in front* (dorso-anterior position), and the *head lower* than the breech (at least early in labor or before it begins), one may inwardly *guess* (often correctly) both presentation and position by *inspection alone*. *Palpation* in dorso-anterior positions

FIG. 161.



Diagnosis of shoulder presentation by palpation. (After PARVIN.)

reveals hard, round, regular tumor of head on one iliac fossa, and soft, irregular tumor of breech high up in opposite flank, partly concealed behind false ribs or by the liver (see Fig. 161). Resisting plane of back follows curved line between these two. Above the resisting plane, toward the breech, are felt the small parts in elastic space occupied by liquor amnii. The excavation is usually empty, or small projection of present-

ing shoulder may be discovered behind horizontal rami of pubes beginning to sink into brim. The head on the iliac fossa may be made to ballot. *These are the conditions observed early in labor or before it begins.*

Later in labor, after membranes are ruptured and child's body becomes compressed by contracting uterus, the line of resisting plane of back becomes more vertical; the breech is forced more over to the median line, and plane of back appears to join head tumor almost at right angles.

In *dorso-posterior* positions (extremely rare) palpation reveals hard globe of head in one iliac fossa, and large, soft, irregular breech high up on opposite side. Resisting plane of back being behind cannot be felt, or only with difficulty; while elastic space of liquor amnii and small parts (being in front) are *felt easily*.

By vaginal examination, early in labor, the presenting part and os uteri are found high up and difficult to reach. The bag of waters is elongated in shape, sometimes projecting through the os like a glove-finger. The globe of the head is missing. Vaginal examinations should be made *between* the pains to avoid rupture of membranes.

Diagnosis of Shoulder Presentation.—By its rounded prominence; the sharp border of its acromion process; the clavicle; the spine of the scapula; the hollow of the axilla; and especially by proximity of *ribs and intercostal spaces*.

Diagnosis of One Shoulder from the Other when the Hand and Arm are not Tangible.—1. Observe the opening of the axilla; it always points toward the child's feet. If the feet be, therefore toward the *right* side of the pelvis, the *head* will be toward the *left* side.

2. The scapula, its spinous process especially, will indicate whether the child's back be toward the pubes or toward the sacral promontory.

3. A moment's reflection will show that a child lying across the pelvis (let the reader imagine *himself* to be lying across it), with its *head* in the *right* iliac fossa, and its *back* to the *pubes*, *must* be presenting its *left* shoulder to the pelvic brim—the “position” of the “presentation” being, necessarily, right cephalo-iliac (dorso-anterior). If the axillary opening show the head to be in the *left* iliac fossa, and the position of the scapula show the child's back to be toward the

mother's sacrum, it will still be the left shoulder presenting, the *position*, however, being left cephalo-iliac (or dorso-posterior).

The same data and deduction may be used for the right shoulder and its two "positions."

Diagnosis of One Shoulder from the Other when the Arm is in the Vagina.—Grasp the child's hand as in ordinary hand-shaking. When the palm of the hand of the practitioner and the palm of the child's hand are brought flat against each other, if the *thumbs of the two hands come together*, the hand of the child will be right or left according as the physician is using his right or left.

Again, if the infant's hand be at the vulva, and its palm be turned up toward the symphysis pubis, the thumb will point toward the right thigh if it be the right hand, and to the left thigh if it be the left.

Diagnosis of the "Position" of the "Presentation" by the Presenting Hand.—*Extend* the arm, and place the hand *supine*. The hand will then always point toward the head, and the face of the palm will agree with the surface of the child's abdomen.

Diagnosis of the Elbow.—By its three bony projections—the two condyles of the humerus and the olecranon process of the ulna. The *end* of the elbow, like the axillary opening, points toward the child's feet.

Prognosis of Transverse Cases.—Always serious. Often fatal to the child, sometimes to the mother. Much depends upon the presentation being corrected early, and upon the skill of the operator.

Treatment.—Early correction of the presentation—converting it into a head, breech, or footling—by the operation of version or turning. This may be done either by *external* manipulation; *internal* manipulation; or by a combined modification of both methods, known as *bipolar* version.

In cases of arrested spontaneous evolution, with *impaction* of the child, as shown in Fig. 156, version would be out of the question. The child is usually dead from the compression to which it has been subjected; the method of delivery is embryotomy; usually decapitation (*q. v.*).

Version, and the several modes of performing it, will be considered in Chapter XIX.

CHAPTER XVIII.

INSTRUMENTAL DELIVERY, FORCEPS, ETC.

THERE are four great divisions of operative midwifery—four great methods by which delivery may be accomplished when the natural powers fail. These are :

First. Delivery by forceps.

Second. Delivery by version.

Third. By cutting operations upon the mother.

Fourth. By mutilating operations upon the child.

Each of these includes a variety of different procedures, and there are numerous other minor manipulations (some of which have been already described, and others remain to be considered), which are, of course, obstetrical operations in every sense ; but it is when these minor methods are inefficient that the obstetrician falls back upon one or other of the four great methods of delivery just mentioned. Delivery by *forceps* and by *version* are essentially *obstetrical* operations ; cutting operations upon the mother are distinctly *surgical*, and mutilating operations upon the child are awkwardly of a mixed character. Some recent authors have included *all* operations under the caption of "*Obstetric Surgery*."

It is important to know that *forceps* and *version* are far more frequently required than the other two methods, and will be resorted to occasionally by almost every medical practitioner ; while cutting operations upon the mother, being so rare as scarcely to allow the obstetrician to acquire skill in their performance by experience, ought, in the interests of the patients, to be done by one possessing surgical skill, when such can be obtained without injurious delay. Under opposite circumstances every obstetrician should know how to do these operations, and not hesitate in undertaking their performance himself. Mutilating operations upon the child are seldom required, at least in this country, where pelvic deformities

(their chief field) are comparatively infrequent. While they demand care, manual dexterity, and deliberation in their performance to avoid wounding the mother, they are done without hemorrhage (at least from the living), and are therefore exempt from that "fear of blood" which is apt to unnerve and disturb the self-possession of one unaccustomed to performing surgical operations. In the interests of living children they are being largely supplanted by improved methods in doing cutting operations upon the mother.

FILLET, BLUNT-HOOK, VECTIS, FORCEPS.

A description of the forceps may be fittingly preceded by a brief account of the other instruments here named. The *fillet* is a noose of cotton, silk, or leather tape, or an uncut

FIG. 162.



The blunt-hook.

skein of worsted, used for traction. The loop having been passed around the part to which it is to be applied, the other end of the fillet is put through the noose and drawn to form a slip-knot. The whalebone fillet consists of a long slip of this material, the ends of which are bent toward each other and joined in a solid handle. A good fillet may be made by passing a strong piece of tape through a piece of stout rubber tubing, the tape being sewed to the tube at each end, where it projects a sufficient length to admit of a knot being made to facilitate introduction, etc. The fillet is seldom used except for the occasional assistance it may render in certain arm and breech cases already mentioned. If the end of the fillet cannot be passed by the finger, use a large gum-elastic catheter with stylet, bent to suit the case, with a piece of tape fastened to its extremity. When the catheter is in position the fillet may be fixed to the tape and drawn through as desired.

The *blunt-hook* (see Fig. 162) is a cylindrical rod of steel, one end of which is attached to a wooden handle, and the

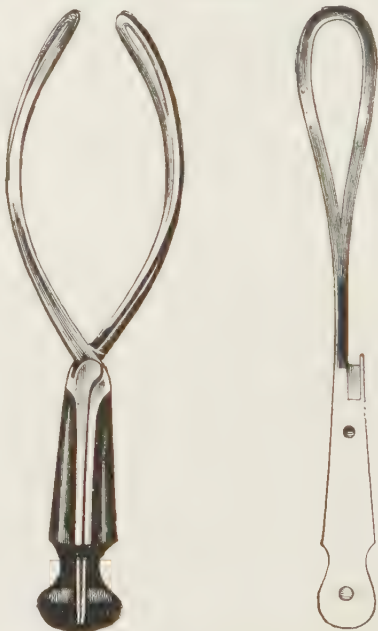
other bent to form a hook, in the end of which is an "eye" through which a fillet may be threaded. It is used as a sort of long *artificial finger* for passing the fillet and making traction; it is but little employed for the delivery of living children on account of injury it is apt to produce; but becomes of great service in the extraction of dead ones during embryotomy operations.

FIG. 163.



Vectis.

FIG. 164.



Denman's short forceps.

The *rectis* is a flattened steel blade with a fenestra, shank, and handle resembling a single blade of the straight forceps, and curved to fit the contour of the fetal cranium. (See Fig. 163.) It is seldom used, but may be of service as a sort of *artificial hand*, in promoting flexion, rotation, and extension, when necessary in the mechanism of labor. As a tractor it has become obsolete since the invention of forceps.

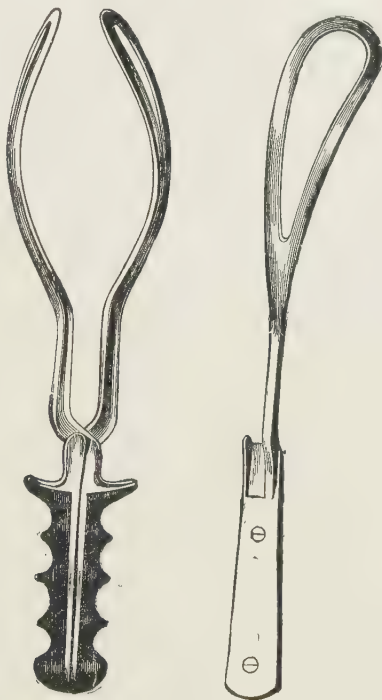
The *forceps* is a sort of pincers whose blades, like a pair of artificial hands, grasp the head and draw it through the pelvic canal.

FIG. 165.



Hodge's long forceps.

FIG. 166.



Simpson's long forceps.

The instrument is composed of the *blades* proper (which grasp the head), the *lock* (where the two halves of the instrument cross each other and are "locked" together), the *shank* (placed between the lock and blades to give length to the contrivance), and the *handles* (which are held by the operator). The two halves of the instrument are separately known as

the "right" and "left" blades, called also "upper" and "lower" and "male" and "female" blades.

Forceps are either "short" or "long." The *short forceps*, called also "straight," have only one curve—the *cranial* curve—which adapts them to fit the cranium. They are only used when the head is at the inferior strait or low down in the cavity of the pelvis. (See Fig. 164, page 352.)

The *long forceps*, beside the "cranial" have also a "pelvic" or "sacral" curve, by which they conform to the axis of the pelvic canal. (Figs. 165 and 166, page 353.) They may be applied at almost any part of the pelvis.

Action of Forceps.—They act chiefly as *tractors*; slightly as *compressors*; scarcely at all as *levers*. They are aids to, or substitutes for, uterine contraction. They occupy but little space, owing to projection of the parietal protuberances through the fenestræ of the blades, which always occurs when the instrument is applied in its most favorable position, the long diameter of the head agreeing with the long direction of the blades.

Cases in which Forceps Are to be Used.—Generally speaking, in all cases where it is necessary to hasten delivery, provided their use for this purpose can be safely and successfully employed. The circumstances under which their application is to be preferred to other modes of operating, and the cases to which they are especially adapted, are so varied and numerous that they need not be recited here; they are considered elsewhere in connection with the different kinds of labor and their complications.

It may be added that unusual frequency (above 160) of the fetal heart sounds, violent fetal movements, and discharge of meconium (in cases other than breech presentation) indicate speedy delivery for the child's sake, for which forceps may be used in suitable cases.

The "High" and "Low Operation."—When the head (or face) of the child is at the inferior strait, or low down in the pelvis, it constitutes the "low operation," and is comparatively easy. When the head is at or above the superior strait or occupying the higher planes of the pelvic cavity, it is the "high operation." This distinction is important. Difficulty and dangers of forceps operations increase, *cæteris paribus*, from below upward.

Conditions Essential to Safety in Delivery by Forceps.—

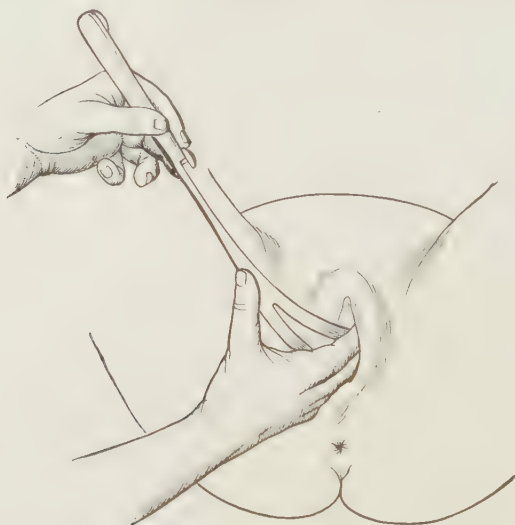
The os uteri must be dilated; the membranes ruptured; the rectum and bladder empty; the pelvis of sufficient size to admit the child; and the operator must possess a requisite amount of knowledge, strength, and manipulative dexterity. Forceps, however, may be applied *before* the os uteri is completely dilated (if it be patulous and dilatable) and before the head has passed through it, provided the dangers of delay are manifestly greater than the risks incurred by introducing the blades of the instrument into the uterus.

Antiseptic Preparation.—Make the abdomen, thighs, and vulva aseptically clean by scrubbing with soap and water and applying a 1:2000 bichloride solution. Cleanse the vagina thoroughly with a hot 2 per cent. creolin solution. The hands of the operator are prepared aseptically as usual. (See “Labor,” page 241.) The forceps are rendered sterile by boiling and placed in a 5 per cent. carbolic acid solution—preferably in a deep pitcher—ready for use. Before introducing each blade, lubricate it with carbolized vaseline or mollin, 5 per cent. Aseptic needles and sutures will have been previously prepared for the perineum as a matter of course.

Mode of Application at the Inferior Strait when the Occiput has Rotated to the Pubic Symphysis.—This is the simplest and most easy of all forceps operations. Place the woman on her back. Anæsthesia may or may not be necessary, according as the pain and difficulties to be anticipated are, respectively, great or little. Assistants, at least one even in the simplest cases, will be required, but an intelligent nurse will often be sufficient. When anæsthesia is used, additional assistants become necessary: one to give ether and two others (one on each side) to support the lower limbs. The “left” (“male,” “lower”) blade is introduced first. Which of the two blades this *is* may be ascertained as follows: Before they are taken apart look at the lock of the instrument, while it is held with the convex border of the sacral curve downward and the handles toward you, and ascertain which shank is uppermost; it is the one whose handle is toward your right hand (the “upper,” “female,” “right” blade). Lay it aside; the other blade, held in the left hand, must be introduced first. Grasp it just above the lock, much in the same manner as you would a pen, so that the handle rests between the thumb and

the index-finger, and upon their junction. One or two fingers of the *right* hand are now *first* introduced between the child's head and left lateral wall of the vagina and retained there, while the end of the blade is placed against their palmar surface, and by gentle pressure made to glide in and up between the head and fingers. (See Fig. 167.) At first the end of the *handle* is directed rather toward the right thigh, but is gradually brought further down and toward the median line as the blade ascends the vagina. A gentle, *limited*, up-and-down

FIG. 167.



Use of forceps at outlet. Introduction of first blade. (ZWEIFEL.)

movement of the blade, rocking it first up toward the pubes, then down toward the coccyx, may facilitate its entrance when the size of the head makes it a tight fit. The fingers inside, having ascertained that the blade is entering properly, are gradually withdrawn; and when the end of the instrument has about passed the equator of the head the left hand is placed above and nearer the end of the handle, which is now depressed toward the perineum, where it is held steady by an assistant, while the other blade, held in the right hand and

preceded by two fingers of the left, is introduced along the right lateral wall of the vagina on the other side of the head, in a similar manner. (See Fig. 168.) When properly applied, the second blade crosses the first one near the lock. The next step is to lock them.

The operator, taking a handle in each hand, by slight adjusting movements gets both blades on a proper level, the lock slips into position, and the instrument is ready for traction.

FIG. 168.



Introduction of second blade. (ZWEIFEL.)

In forceps like Hodge's, having a screw lock, the screw must be tightened before performing traction. In *applying* the forceps, proceed only *between* the pains; in using *traction*, only *during* the pains. In the absence of pains, imitate them by intermittent tractions and intervals of rest; each continuous pull not to be longer than one minute. In drawing out the head by traction, avoid haste and violent pulling (unless imperatively required); draw by the strength of the hands and arms, not by hanging the weight of the body on the instrument; direct traction in a line with the axis of the pelvis.

While one hand grasps the handles let the other grasp the lock, and rest the tip of its index-finger against the occiput to guard against the head slipping out of the blades; in resting from traction efforts between the pains, see that the handles are *not* held tightly together, so as to make *continuous* compression, by the blades, upon the head. Keep the handles

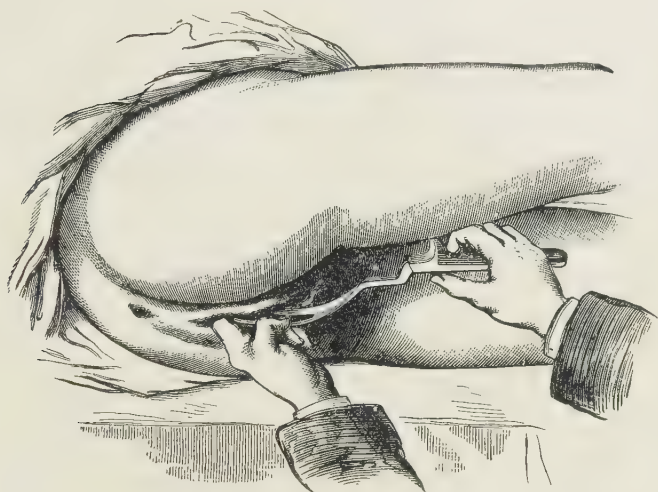
FIG. 169.



Lifting handles to follow extension.

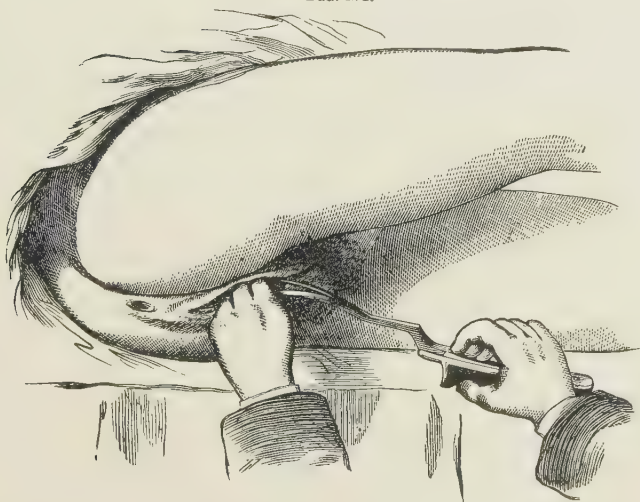
down so that traction is made about in a horizontal line until the occipital end of the occipito-mental diameter is beginning to escape under the pubic arch, then gradually lift them up, in a line with the axis of the outlet, toward the mons veneris, in order that "extension" of the occiput up

FIG. 170.



Introduction of lower blade of forceps.

FIG. 171.



Introduction of upper blade.

in front of the pubic symphysis may take place. (Fig. 169, page 358.) Inexperienced operators *usually* continue traction too long before beginning extension. When occiput is well below pubic arch and back of child's neck behind pubes, pulling does no good; extension, by lifting handles toward pubes, must now begin. Watch the perineum and guard it from rupture as the biparietal equator emerges. Readjust the in-

FIG. 172.

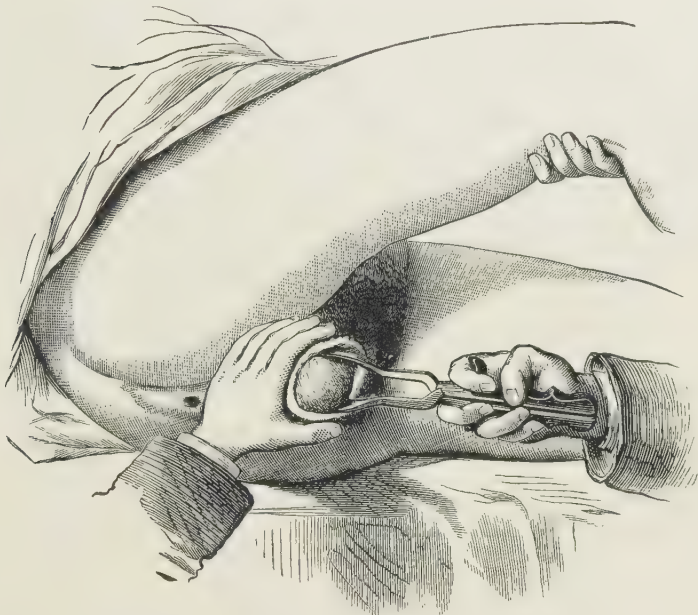


Forceps in position. Traction in axis of brim, downward and backward.

strument from time to time without withdrawing it, if necessary, to keep the long direction of the blades parallel with the long diameter of the head (especially during "extension"), otherwise the terminal extremities of the blades will project and injure the perineum or vagina. To avoid this risk more completely, some operators take off the instrument just before the head emerges, and finish delivery, if further artificial aid be necessary, by manipulation—a finger introduced into the rectum drawing on the chin.

While thus far we have referred to the application of forceps with the woman lying upon her back—the usual position in the United States—the method of using the instrument with the woman in the English position, upon her left side, may be at once understood from the preceding illustrations taken from the work of Playfair, of London. (See Figs. 170–173.)

FIG. 173.



Last stage of extraction. The handles being gradually turned up toward the mother's abdomen, to deliver by "extension."

Oscillatory or "Pendulum Movement."—During traction it is *not* necessary (as was formerly supposed) to sway the handles to and fro, laterally, with a view of levering the head out of the pelvis as a carpenter "rocks" a nail in withdrawing it from a board. Since there is no ratchet-like roughness either to the pelvic canal, forceps, or head, nothing can be gained by this movement, while the sweep it necessarily gives to the ends

of the blades may injure the soft parts. In certain cases where the head is fixed and firmly impacted in the pelvis, such a motion may be justifiable to dislodge or loosen it, but after this the lateral movement is useless.

Authorities differ on this matter; some continue to practise the pendulum movement, and explain the theory of its action satisfactorily to themselves; others do not.

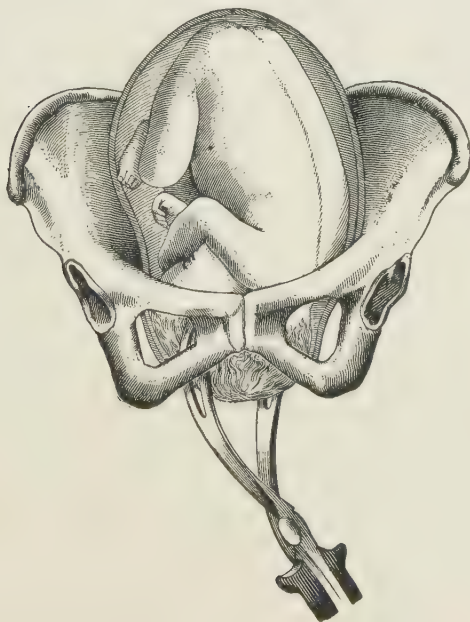
Since the pinch is most often in the *antero-posterior* diameter of the pelvis, the *lateral* movements would seem merely to swing the head from side to side round a central pivot running from sacrum to pubes. Theoretically the to-and-fro movements would appear to be called for *in the other direction*—antero-posteriorly—in order to lever the head down through the two ends of the obstructing conjugate.

Applications of Forceps at Inferior Strait when the Occiput Has Rotated to the Sacrum.—Forceps should not be applied at all in these cases until a reasonable time has been allowed and every proper effort made (see page 297) to promote anterior rotation, unless, indeed, accidental circumstances render delay dangerous. Then, however, the operation is as follows: The blades are put in exactly as described for cases where the occiput has rotated anteriorly. But since the occiput is now toward the sacrum, the *extension will, of course, be downward and backward over the perineum*, instead of upward toward the pubes; hence the handles of the instrument, at first lifted somewhat upward toward the pubes to draw the occiput up to the edge of the perineum, must, when the head emerges, be directed *downward and backward*, instead of toward the *mons veneris*. A moment's reflection will show that the short *straight* forceps (without any *sacral curve*) should be used in these cases; for the said curve is only adapted to follow the axis of the pelvic canal, but during *backward* extension of the occiput over the perineum the head departs from the axial line and goes in an almost opposite direction. If the *curved* forceps were used, the ends of the blades would impinge against the pubic arch while the handles were being depressed in following the movement of backward extension. Again, owing to the depth of the posterior pelvic wall being three times as great as that of the anterior one, there is so much the more difficulty in getting the occipital end of the occipito-mental diameter to escape over the edge of the perineum,

hence greater danger of laceration, and necessity for extra care that the occipital pole *really* shall have cleared the perineum before extension is attempted.

In the cases of occipito-posterior rotation, in which the forehead, face, and chin successively escape under the pubes (which sometimes goes on while the forceps are being used), the case becoming a face presentation at the last moment (see "Mechanism of R. O. P. Position," page 295), the handles are elevated toward the pubes, for, the chin having emerged, the mechanism is completed by its *flexion* up toward the *mons veneris*.

FIG. 174.



Forceps applied at inferior strait; occiput to *left acetabulum*.

Application of Forceps at Inferior Strait when the Occiput is Toward One of the Acetabula.—Here *no* rotation has occurred. The long diameter of the head occupies the same oblique diameter by which it entered the superior strait.

As a general rule, apply the blades just as if rotation had occurred, for during the subsequent traction *rotation will take place inside the instrument*. The blades conform to the *sides of the pelvis*, but grasp the *head obliquely*, one over the *side* of the forehead, the other over the *side* of the occiput. They do not so nearly approach each other, hence the handles are wider apart, and the forceps are more apt to slip during traction—an accident to be avoided by additional care.

Another mode of operating is to place the blades over the *sides* of the unrotated *head*, one blade being passed in along the sacro-iliac synchondrosis, the other near the opposite acetabulum. When the instrument is thus adjusted, the handles will be directed decidedly toward that thigh corresponding with the acetabulum at which the occiput is placed. (See Fig. 174.) Before or during the first traction efforts the occiput is made to rotate to the pubes by gently directing the handles to the median line of the inter-femoral space. This mode of operating, while more scientific and desirable than the other, requires, in most cases, a special skill, and from its difficult execution is not resorted to as often as the simpler method first above given.

In doing the operation the thighs must be forcibly flexed to get them out of the way of the handles of the instrument.

When the occiput is to *left* acetabulum apply *lower* blade *first* along left sacro-iliac synchondrosis; then second blade behind right acetabulum.

When occiput is to *right* acetabulum it is best to apply the *upper* blade first, along right sacro-iliac synchondrosis, and holding its handle up and on one side, out of the way, put in second blade underneath it, behind left acetabulum.

Application of Forceps at Inferior Strait when the Occiput is Toward One of the Sacro-iliac Synchondroses.—This is still more difficult than in unrotated *anterior* positions, but the two modes of operating just mentioned—viz.: placing the blades either on the sides of the *head* or on the sides of the *pelvis*—may be employed.

Every effort should be made to rotate the occiput *to the pubes*; failing in this, there is nothing left but to rotate it to the sacrum and deliver it in accord with the mechanism of occipito-posterior positions. (See page 292.)

There is, however, an entirely *different* way of using the

forceps in these cases. Note that in all the methods of application thus far described, the blades have been put on so that the *occipital pole* of the head was directed toward the *lock* of the instrument. In the method now to be described the blades are so put on that the *forehead* is directed toward the *lock*. Then the handles are directed *backward*, carrying the forehead in a *posterior* direction, which of necessity carries the occiput *forward*, and its anterior rotation is accomplished. But when this has been done the forceps will be upside down; the convexity of the pelvic curve will be in front toward the pubes. The blades must, therefore, be taken out and re-applied, as in an anterior position of the occiput which has been now produced. To illustrate: Suppose the occiput is toward the *right* sacro-iliac synchondrosis (by far the most common of the two occipito-posterior positions), the forehead will, of course, be at the *left* acetabulum. The left (lower) blade, held in the left hand and guided by the right hand, is passed along the left side of the vagina toward the left sacro-iliac synchondrosis until it gets over the child's ear. This blade is now held in place by an assistant, while the second (upper) blade, held in the right hand and guided by the left, is passed along the right side of the vagina and manipulated forward until it is at the right acetabulum, over the child's other ear. Then lock the blades. Now the blades grasp the sides of the head, the *forehead* being toward the lock of the instrument and the handles pointing obliquely upward toward the left acetabulum. During traction efforts, just as soon as the head gets down on the pelvic floor, the *handles are directed* (not forward toward the pubic symphysis as they would be if the *occiput* were toward the lock) downward and outward toward the sacrum, until pointing toward the left sacro-iliac synchondrosis, to which the forehead is thus rotated; and, of necessity, the occiput has been rotated to the right acetabulum; it has become an R. O. A. position. The forceps, by directing the handles backward instead of forward, have, of course, become upside down. They are easily taken off and re-applied in the usual manner already described for cases with "the occiput at one end of the acetabula" (page 363). This method is attributed to Scanzoni and is spoken of as a "double" application of forceps. J. Whitridge Williams, whose wide experience entitles his opinion to great considera-

tion, states that delivery is so safely and readily accomplished by this method that he no longer dreads occipito-posterior presentations. Hence I have described it with some detail.

Application of Forceps when the Head is in the Pelvic Cavity Between the Two Straits.—General methods the same

FIG. 175.



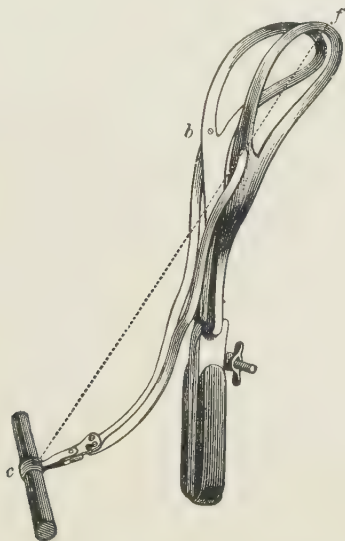
Lusk's modification of Tarnier's forceps.

as already described. The instrument requires to be passed further up (hence long, curved forceps are necessary), and the traction must be made more in a backward direction, in conformity with axes of higher planes of pelvic canal, by

directing the handles more decidedly downward toward the perineum while pulling efforts are being made.

In these cases, as in all others where the head may not have passed entirely through the os uteri, the fingers that precede the introduction of the blades should feel that the ends of the instrument *certainly* pass between the head and the lips of the os, and not outside the latter so as to pinch it between the head and blade.

FIG. 176.



Simpson's axis-traction forceps.

The "High Operation"—at or Above the Superior Strait.
—It is very difficult. In many instances podalic version is safer and easier if the conditions favorable for it be present. When the head has not sufficiently descended to fix it in the brim, but remains movable above the superior strait, version is usually preferable. The forceps is introduced in the usual manner, but, of course, higher up, so that even the lock may enter the vulva. The blades follow the *sides of the pelvis*, no matter what "position" the head may occupy, hence they

grasp the latter obliquely, and there is great liability to slipping of the instrument, and danger of the tips of the

FIG. 177.



Walcher's position. (FOTHERGILL.)

FIG. 178.

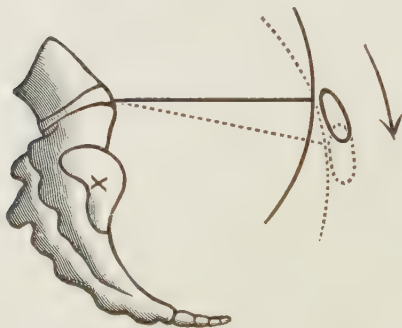
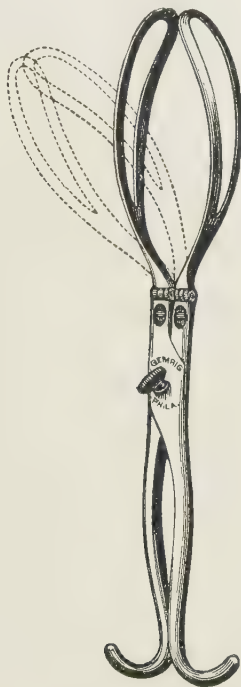


Diagram to show increase in conjugate in Walcher's position. The dotted lines show pubes and conjugate with the legs hanging down. The plain lines show the same when the legs are supported. Rotation occurs about the point X.

blades injuring the interior of the uterus. Traction must be made very slowly at first, and *decidedly backward* and downward in line with the *axis of the plane of the superior strait*, by keeping the handles as near the coccyx as possible. To facilitate this backward traction, Tarnier has constructed a special instrument (Fig. 175, page 366) with curved handles,

FIG. 179.



McFerran's forceps.

perforated by a screw to hold the blades in contact with the child's head; these handles steady the instrument and indicate the *direction* of traction; the *force* of traction is applied to the lower handle, or cross-bar, attached to the traction rods fastened to the blade at *b* (Fig. 176). The direction in which axis-traction can be thus employed is well illustrated

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by the dotted line in Fig. 176, showing Simpson's modification of Tarnier's instrument. An hour may be required to bring the head down to the pelvic floor, and care must be taken to direct it in accordance with the natural mechanism

FIG. 180.



Stephenson's method of
axis traction.

FIG. 181.

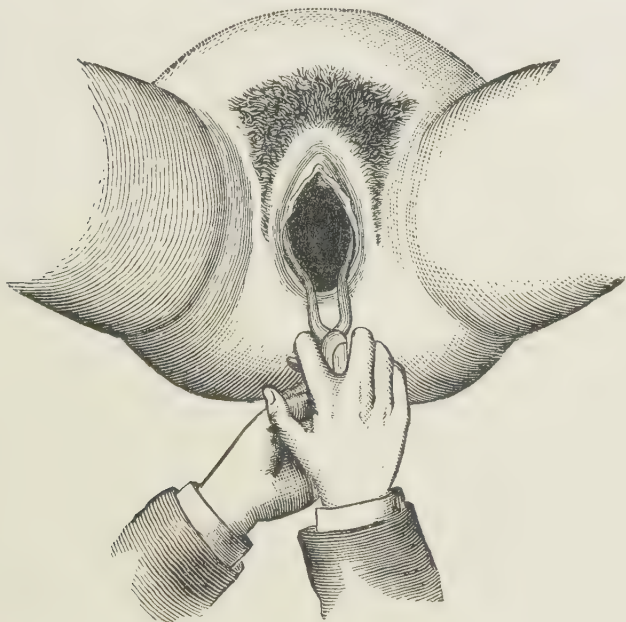


Breus's axis-traction forceps.

of labor as far as practicable ; and also that the traction consist of alternate pulls and pauses, in imitation of natural labor pains.

Recently *Walcher's position* (see Fig. 177) has been used in these difficult cases to increase the conjugate diameter of the superior strait. The woman is placed on her back with her hips not simply *at*, but projecting *over*, the edge of the bed, her legs hanging down toward the floor without any support whatever. The bed—preferably a table—must be sufficiently high to prevent the woman's feet touching the floor. This slightly lengthens the distance between the sacral promontory and symphysis pubis, as shown in Fig. 178, page 368.

FIG. 182.



Traction with Simpson's forceps.

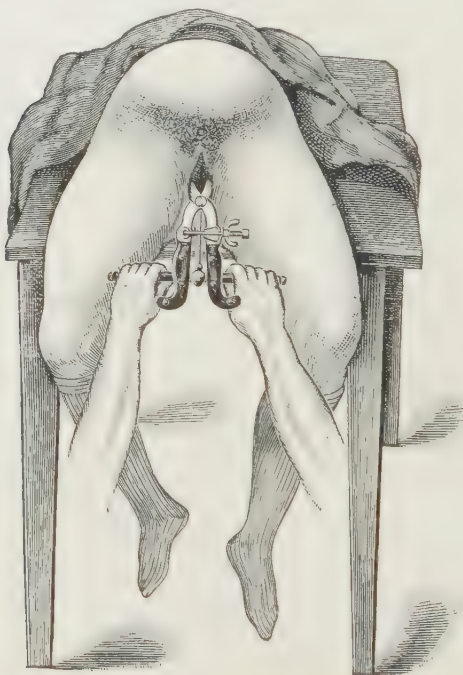
When the head reaches the inferior strait the lower limbs must be supported and flexed as usual. While *Walcher's posture* *lengthens* the conjugate of the *inlet*, it *lessens* that of the *outlet*.

For securing axis-traction various modifications of the

forceps have been contrived, notably that of McFerran of Philadelphia (Fig. 179), and Breus's axis-traction instrument (Fig. 181).

Stephenson, of Aberdeen, uses a steel rod hooked in front of the lock, as shown in Fig. 180.

FIG. 180.



Traction with axis-traction forceps. The woman should be in the Walcher position as here shown.

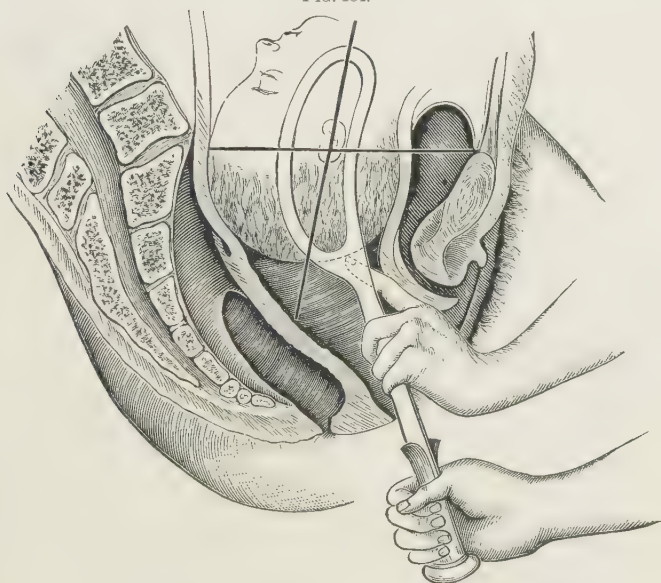
A still better device is the traction rods of Reynolds—two separate steel rods hooked into the fenestræ of the blades after their introduction, the other ends being curved round the perineum and fastened to a solid transverse handle for axis-traction.

The methods of making traction with ordinary forceps and

with axis-traction instruments are well seen in Figs. 182, 183, 184, pages 372, 372, and 373.

If the head be altogether *above* the superior strait, and *movable*—i. e., not yet fixed in its position by any partial engagement at the brim—version should *certainly* be preferred to forceps.

FIG. 184.



Axis-traction with ordinary forceps. Head at superior strait.

Dangers of Forceps Operation.—Laceration and bruising of the uterus, vagina, and perineum; the vaginal injuries sometimes involving rectum, bladder, and urethra, thus leading to subsequent ulceration and fistulæ; rupture or injury to veins and subsequent phlebitis; possibly fracture of pelvic bones and separation of pelvic joints when great force is employed. Dangers to the child are: abrasion, contusion, and laceration of the skin; depression or fracture of cranial bones; laceration of bloodvessels and consequent subcutaneous hematoma; temporary facial palsy from injury to facial nerves.

Though no lesion may be apparent externally, the child's brain may have been injured, and idiocy or other form of mental disease result in consequence.

The *prognosis* in forceps cases largely depends upon the conditions preceding and requiring their application, and upon the care and skill of the operator. It is, of course, more favorable, other things equal, in proportion as the head is low in the pelvis.

FIG. 185.



Forceps in face presentation at outlet.

Forceps in Face Presentations.—When the face is at the *inferior* strait and the chin has rotated to the pubes the operation is easy and almost identical with that described for head cases with the occiput to pubic symphysis. The blades are applied on each side, and, after traction has brought the tip of the chin well out under the pubic arch, the handles are directed up over the mons veneris, to promote delivery by flexion. Care must be taken to pass the blades *far back* so that their terminal ends fit *round* the occipital end of the head, instead of *digging into it*, when the handles are compressed. (See Fig. 185.)

When the chin is toward one of the acetabula at the lower strait the same rules may be applied as for corresponding unrotated anterior positions of the occiput. In face cases, how-

ever, the chin is apt to be somewhat *behind* the acetabulum, nearer the centre of the ilium, the face and head more directly transverse in the pelvis than occurs in vertex presentation. In these the blades cannot well be applied to the *sides of the pelvis*, but should be passed, one along the sacro-iliac junction and the other near the opposite acetabulum, so as to grasp the *sides of the head*, and rotation *must* occur, either spontaneously or by the aid imparted by the blades, *before traction can do any good*.

FIG. 186.



Forceps applied to after-coming head when occiput has rotated to pubes.

When the chin has rotated *to the sacrum*, delivery by forceps is mechanically impossible (see "Mechanism of Face Cases," page 305) if the fœtus and pelvis are of normal size. When the face is at the *superior strait*, or high up in the pelvic cavity, and circumstances *require delivery to be hastened*, version must be preferred to forceps. And when version cannot be accomplished, the only remaining resorts are craniotomy and Cæsarean section.

Forceps to the After-coming Head in Breech Cases.—When the several manipulations already described (see pages

326-329) for delivery in these cases fail, forceps may be tried.

In the more common cases in which occiput has rotated to pubes and forehead to sacrum, the body of the child is lifted up toward the mons veneris, and the blades are applied one on each side of the head, as before described, the handles being first depressed toward the perineum, especially when the head is high up, but made to follow the body toward the mons veneris, as the chin, face, and forehead successively emerge over the coccyx. (See Fig. 186.)

When the occiput has rotated to the sacrum, the direction in which the child's body is held during the use of the instrument will depend upon whether the chin is caught *above* or dipping *below* the pubic arch. In the *former* (and rarer) case, the body is lifted toward the pubes, while the forceps are passed in to the occiput, which is drawn out *first* along the sacrum to the perineum ("continued extension"), the handles being lifted toward the child's back as the head is born. (See Fig. 141, page 323.)

In the latter case ("continued flexion") when the chin is *below* the pubes, the body must be depressed toward the perineum, while the blades, having been applied to the sides of the head, the handles (as the chin, face, and forehead come out under the pubic arch) are depressed toward the child's abdomen. (See Fig. 140, page 322.)

The application of forceps when the after-coming head is arrested at the *superior strait*, is a difficult operation, and manual pressure from above, conjoined with every other means stated under the "Treatment of Breech Cases" (page 326), should be faithfully tried before attempting their introduction. Their use, however, is to take precedence of craniotomy in any case where this is likely to become necessary, especially if the child be still alive.

CHAPTER XIX.

VERSION OR TURNING.

VERSION is an operation by which some part of the child other than that originally presenting is brought to the superior strait. When the *head* is brought down, it is "cephalic" version; when the *feet*, "podalic."

When a face or brow presentation is changed by flexion into a head presentation, it is spoken of as "version by the vertex."

The cases in which version may be required are: transverse presentations; sometimes in head, face, and breech presentations; certain cases of moderately contracted pelvis; and in cases where accidental circumstances render rapid delivery necessary, such as placenta prævia, rupture of the uterus, prolapsus of funis, convulsions, tedious labor, etc., provided delivery by forceps is not safe or practicable.

The operation is contra-indicated in cases where the pelvis is too small to admit delivery without mutilation after it is done; also when the presenting part (other than the arm, of course) has so far passed through the os uteri that it cannot be returned; and in cases with thinning and distention of the lower uterine segment, and rising of the retraction ring of Bandl two inches or more above the pubes, when version would almost certainly cause rupture of the uterus.

Choice Between Cephalic and Podalic Version.—When correction of a malpresentation is *all* that is required, and circumstances do *not* render subsequent immediate delivery necessary, perform cephalic version. When rapid delivery *is* necessary, podalic—bring down feet, that traction may be made and delivery completed at once.

Methods of Operating.—Each of the two operations (1) *cephalic* and (2) *podalic* version, may be performed in three ways: 1. By external abdominal manipulation. 2. By com-

bined external and internal manipulation, the *fingers only* going into the os uteri. 3. By internal manipulation, the *whole hand* passing into the *uterine cavity*.

Antiseptic Preparations.—Before any version operation the abdomen, thighs, and external genitals of the woman, together with the hands and arms of the operator, must be made aseptically clean (as already explained, Chapter XII., page 240); and when the fingers or hand are to enter the uterus, the *vagina* and *cervix uteri* must be *first* thoroughly sterilized with the 2 per cent. creolin solution, or the 1 : 4000 mercuric bichloride solution. When the operation is done, and the third stage of labor completed, the *uterus* and *vagina* must be washed out with the creolin solution.

VERSION BY EXTERNAL MANIPULATION.

Chiefly employed for correcting transverse presentations, either before labor begins or, labor having begun, before the waters have been discharged, or as soon thereafter as possible, while the child is easily movable and has not become fixed by engagement of the presenting part in the pelvic brim. It may also be done in breech cases; changing the breech into a head presentation. The method of changing a face presentation into one of the head by external manipulation has already been described under "Face Presentations."

Operations in Transverse Presentations.—Having previously made out the exact position of the child (head in one iliac fossa, breech in opposite flank), place the woman on her back, with the lower limbs straight out and feet slightly apart; uncover the abdomen, and stand facing the woman—while the hands—one on the child's head, the other on its breech—make *steady* pressure with a stroking, gliding motion, in a direction to turn the head down toward the brim and breech up toward the fundus uteri. For example: In the dorso-anterior *position* of a right-shoulder *presentation* (see Fig. 152, page 341), the right hand will grasp the head in the left iliac fossa, and gently press it down toward the pubes, while the left hand laid flat upon the other side of the abdomen, with the finger-ends pointing toward the fundus uteri, will push the breech obliquely *upward* and toward the median line. During a pain stop manipulating, holding the child just firmly enough to

retain any degree of change in its position already gained. Pressure in the intervals. When the child slips round into its right position rupture the membranes (if labor have begun), that the womb may contract and keep it there. If labor have *not* begun, place two pads—one on the side of the uterus high up against the breech, the other on the opposite side lower down, against the head—and retain them with an abdominal bandage; or press down the head and hold it in the pelvic brim by abdominal manipulation until it become fixed by engagement at the superior strait, and thus maintains its new and correct position.

In thus bringing the *head* into the pelvis, *cephalic* version is accomplished. Should there be any coexisting necessity for speedy delivery, *podalic* version should be done instead by pressing the head up into the fundus and the breech down into the pelvic brim.

Operation in Breech Presentations.—The woman having been placed in position as before described, the operator stands on that side of her toward which the child's abdomen is directed; for example, the child's back being toward her right side, he stands on her left. His right hand is placed on the fundus uteri and the head pressed laterally and down toward the left iliac fossa, while the left hand, placed transversely above the pubes (finger-ends pointing to her right), push the breech laterally toward the right iliac fossa. The child's body having been thus made to *begin* the desired change, the pressure is continued, right hand pressing head down into the pelvic inlet, left one pushing breech upward into fundus uteri. Should the beginning of the change be difficult to accomplish, owing to the breech dipping a little into the pelvic brim, one or two fingers may be passed into the vagina, and the breech lifted above the brim, while the other hand makes pressure on the head externally. As a rule, the pressure upon the breech will be more efficient than that upon the head. The operation is easier in multiparæ than in primiparæ. After several successive failures to turn the child, the operation should be abandoned.

Operation in Head Presentations.—Changing a head presentation into a breech by external manipulation, comprises the same methods (reversed) as those just described for changing the breech into a head presentation.

Version by Combined Manipulation.—When version by external manipulation is necessarily impossible, or has failed after trial, the second least dangerous method, by combined manipulation, should be tried. This consists of manipulating outside with *one* hand while the other is passed into the

FIG. 187.



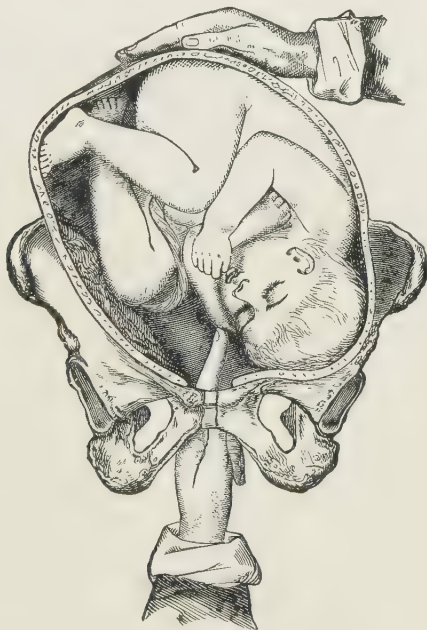
Bipolar version (first step).

vagina, two or three of its *fingers only* going into the *uterus*. The hand outside pushes down the part it is desired to bring to the superior strait, while the fingers inside simultaneously move the part at the os out of the way and upward along the

opposite side of the pelvis. Thus, in *head presentations*, when it is desired to bring down the feet, the operation comprises three steps:

Operation of Bipolar Version in Head Presentations.—1. The fingers inside lift the head toward that iliac fossa toward which the occiput points, while the hand outside depresses the breech along the opposite side of the womb (Fig. 187). This having been done—

FIG. 188.



Bipolar version (second step).

2. The fingers inside can now touch the shoulder, and they push or lift it in the same direction as the head, while the hand outside still further depresses the breech (Fig. 188). The head is now a little higher above the brim than the breech, and the knee is within reach of the fingers.

3. Grasp the knee (the membranes, if unbroken, may be ruptured) and pull it down, while the hand outside *changes*

its position so as to push up the head toward the fundus (Fig. 189). The foot may now be reached and the case managed as a breech or footling presentation.

In *transverse presentations* the operation comprises the second and third steps above given for head cases—that is, push the shoulder after the head, then grasp the knee, etc. Should it be desired, however, to convert the shoulder (transverse) presentation into a head presentation instead of a footling, the

FIG. 189.



Bipolar version (third step). The external hand, as shown in the figure, has not yet changed its position, but is ready to do so.

fingers inside will, of course, push the shoulder in the direction of, and *after the breech*, while the hand outside *depresses the head* toward the pelvic brim.

Bipolar Version in Face Presentations.—Operation is essentially the same as previously described for head presentation.

The fingers inside during the first step push the face toward that side of the pelvis opposite the chin—*i. e.*, they lift it on to that iliac fossa toward which the *forehead* is directed.

Value of Bipolar Version.—It should be particularly observed that the *main purpose* of this combined or “bipolar” method is to supersede the more dangerous proceeding of introducing the whole hand and part of the forearm into the uterus, which is the only mode of version remaining when the external and bipolar methods have been unsuccessful. The bipolar method can be done before the os uteri is sufficiently dilated to admit the whole hand.

VERSION BY INTERNAL MANIPULATION.

Like all the version operations, this is comparatively easy before the waters have escaped and when the uterus is not rigidly contracted round the child, but difficult when opposite conditions prevail. Additional conditions, however, are necessary before the operation should be attempted, *viz.*, the pelvis must be of sufficient size to admit the hand; the os uteri must be dilated or dilatable; the head (if it present) must not have passed through the os uteri, and the presenting part (whatever it may be) must not have descended so low or become so firmly impacted in the pelvis that it cannot be pushed back above the superior strait without risk of lacerating the utero-vaginal junction or other soft parts.

Internal Version in Head Presentations.—The operation comprises three steps:

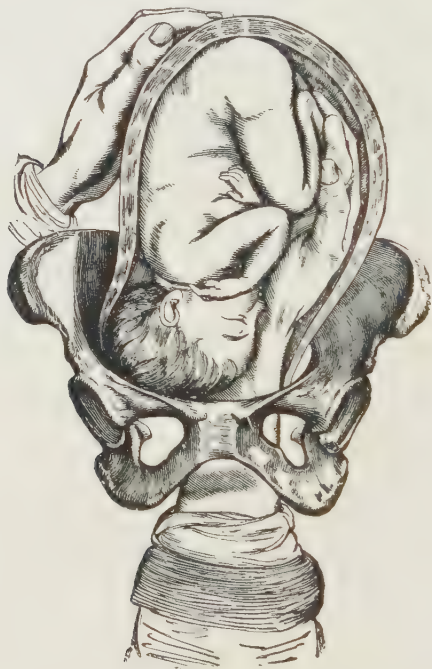
1. Introduce the hand and grasp the feet.
2. Turn the child.
3. Extract the child.

The first *two* steps are to be proceeded with only *between* the pains, the *third* step only *during* the pains. When a pain comes on during the first two parts of the operation, hold the hand still, relaxed, and flat, and thus avoid risk of rupturing uterine walls with the knuckles.

Operation.—The woman is placed on her back, the hips brought to the edge of the bed, the legs properly supported; the operator *sits* between them on a low seat. If the womb be firmly contracted and waters discharged, *complete* anæsthesia is required.

Bare the arm to above the elbow, and anoint it with carbolized vaseline on all parts except the palm of the hand. Use the hand whose palm corresponds to the abdomen of the child, viz., in the L. O. A. and L. O. P. positions, the left hand; in the R. O. A. and R. O. P. positions, the right hand.

FIG. 190.



Podalic version; grasping the feet.

The finger-ends are brought to a cone over the end of the thumb, and the hand introduced into the vagina (with a slight rotary movement, if necessary) in the axis of the pelvic outlet, its back toward the sacrum. The finger-ends and hand are then pressed on into the os uteri, the elbow being depressed toward the perineum so as to bring the hand in line with the axis of the brim, while the other hand rests

outside, making support and counter-pressure upon the fundus.

With the thumb between the head and pubes, and the four fingers between the head and sacrum, the head is grasped and lifted out of the way, "on the shelf" of that iliac fossa toward which the occiput points. The wrist resting against

FIG. 191.



Podalic version: turning the child.

the forehead keeps it there, while the hand goes on up to grasp the feet, the other hand continuously supporting the fundus (see Fig. 190).

The feet (one, or both if possible) are then drawn down, while the other hand depresses the breech, which begins the

second step, or *turning* the child (see Fig. 191). As it gets partly round, the hand outside may change its position to push up the head. The latter having reached the fundus, turning is accomplished, and (the *third* step) *extraction* (during the pains) may be completed, following the mechanism and mode of delivery already described for breech cases.

FIG. 192.



Right hand grasping feet in right shoulder (arm) presentation, dorso-anterior position. (DAVIS, after FARABOEUF and VARNIER.)

Should the membranes be unbroken at the beginning of the operation they should be ruptured when the hand passes by the head into the uterus, the wrist acting as a plug in the os to prevent escape of waters; or the hand may be passed up *between* the unbroken membranes and uterine wall, the bag

being ruptured when the feet are felt. The latter method is objectionable from risk of loosening placenta, unless the operator be skilful.

FIG. 193.



Left hand grasping feet in left shoulder (arm) presentation, dorso-anterior position. (DAVIS, after FARABOEUF and VARNIER.)

Version by Internal Manipulation in Transverse Presentations.—This proceeding comprises the same three steps as just described for head cases, and the same general rules of operating, with modifications now to be noted. In selecting the hand (the woman lying upon her back), use the right hand when the right side (shoulder, etc.) presents, and the left for the left side,

Where to Find the Feet.—In the *right* shoulder or arm “presentation,” when the “position” is *dorso-anterior* (*left* cephalo-iliac), it is evident the feet will be found toward the

FIG. 194.



Right hand grasping feet in right shoulder presentation, dorso-posterior position. (DAVIS, after FARABOEUF and VARNIER.)

right and *posterior* part of the womb, above the *right sacro-iliac synchondrosis*, hence easily reached by passing the right hand along the hollow of the sacrum, to the *right* of its

promontory, and then higher, toward the posterior part of the *right* iliac fossa. (See Fig. 192.)

In the *left* shoulder or arm presentation, when the position is dorso-anterior (*right* cephalo-iliac), it is evident the feet will be toward and above the *left* sacro-iliac synchondrosis, hence easily reached by passing the left hand on the left side of sacral promontory, etc. (See Fig. 193.)

These dorso-anterior positions are *far* more frequent than dorso-posterior ones.

In the dorso-posterior (*right* cephalo-iliac) "position" of a right shoulder or arm "presentation," the feet will rest toward the *left* and anterior part of the uterus above the *left* acetabulum. The right hand, therefore, should be passed along the sacrum as before, but to the *left* side of its promontory, and then higher up toward the posterior part of the *left* iliac fossa (where it feels the back of the child's breech), and must then be *pronated round the breech*, over the thighs, toward the anterior part of the *left* iliac fossa, where the feet will be found. (Fig. 194.)

In dorso-posterior (*left* cephalo-iliac) position of a *left* shoulder presentation the feet will rest toward the *right* anterior part of the uterus above the *right* acetabulum, and will be reached by the *left* hand going behind and pronating round the breech as before described.

There is another mode of reaching the feet in the two dorso-posterior positions, viz., by passing the hand directly up to the feet behind the pubes and acetabulum, instead of going behind the child's breech and pronating round it. This method is made easier by placing the woman on her *side* (the side toward which the feet are directed), while the operator, standing behind her, passes the hand (right one for right lateral "presentation," and left one for left, as before stated), with its *back* toward the *pubes* and acetabulum, directly to the feet. This is shown in Fig. 195, in which, however, the *right* hand is represented as being used instead of the *left* as above described. We therefore assume that in the figure the woman is lying upon her *left* side (upon the side toward which the child's *head* is directed) instead of upon that side toward which the *feet* are. In this posture the right hand is preferable; if she lay on the other side it would be the left hand, as stated in the text.

Which Foot to Pull Down. From the infrequency of transverse presentations, only comparatively few operators have a sufficient number of cases to formulate rules based on their own experience, and those who *have*, do not agree; some prefer one foot, some the other, and find theoretical reasons for their choice. No fixed rules can be stated; much depends

FIG. 195.



Direct method of reaching feet in dorso-posterior cases. (DAVIS, after FARABOEUF and VARNIER.)

on the conditions present in each case—whether difficult or easy, whether early or late, whether with or without some pressing necessity for haste—and a great deal depends upon the acquired skill of the operator.

It is perhaps best to get *both* feet if this can readily be done; if not get one, and in difficult cases with previous delay, discharge of the liquor amnii, rigid uterine contraction, dangers from hemorrhage, impending rupture, or some other pressing

emergency it is perhaps better to *get the first one you can find*, and thus avoid risks of delay and prolonged manipulation in making a selection. In easy, early cases, either foot will do; but a skilled operator would prefer to seize the one diagonally opposite the presenting arm or shoulder—*i. e.*, if the right arm present, seize the left foot, and *vice versa*; this makes turning easier.

Should there be no difficulty in *turning*, there is a decided advantage during *extraction* in selecting the other foot, *i. e.*, the anterior foot, the one belonging to the same side as the presenting arm; this directs the child's body more in line with the axis of the pelvis and prevents the opposite hip catching on the pelvic brim in front.

In transverse presentations, when the child has been *turned*, the case may be left to nature, unless circumstances render rapid delivery necessary, when the *third* step of *extraction* may be performed. If it is to be left alone, only *one* foot should be brought down, so that the buttock of the other side may add to the size of the breech and produce adequate dilatation of the os, so as to permit easy passage of the after-coming head.

Cephalic version by *internal* manipulation is not performed nowadays, owing to the difficulty of grasping the globular head and for other reasons, though it was preferred to podalic version in former times.

Prolapse of the Arm.—A tape may be put upon the arm by which an assistant holds it extended in the vagina, while the operator's hand passes in to perform *internal* version; but it must not be held by the tape so tightly as to interfere with its upward recession when the feet are being drawn down. Traction on the tape may also be used to deliver the arm and prevent its ascending alongside of the head during extraction of the body. In performing *bipolar* version the arm may sometimes be used to advantage in *pushing the shoulder* in the direction of the head, as before explained.

Difficulties of Version.—The external and combined methods of version, when they can be accomplished at all, are done with comparative ease, and only in the more favorable cases. They would scarcely be attempted and seldom succeed in the more difficult cases now to be considered, and in which even internal version is anything but easy.

The most common difficulty is evacuation of the waters and *rigid contraction of the uterus* around the child. The manipulations increase uterine spasm still more; the operator's arm becomes cramped and useless from pressure; the child will not turn; and there is great risk of uterine rupture if violence be employed.

Treatment: Complete anaesthesia to relax the womb, and steady, gentle, persevering efforts on the part of the operator. Should the operator's hand become numbed and useless, it must be withdrawn for recuperation, and re-introduced afterward, or in its place, the hand of a skilled assistant may be resorted to.

Even when the foot has been drawn down to the os uteri, the shoulder (or head, as the case may be) will not recede, and turning seems impossible.

Treatment: Fasten a tape to the foot of sufficient length to be held outside the vulva, on which traction may be made by an assistant, while the hand inside pushes the head (or shoulder) in the proper direction. Make the traction—not straight down—but diagonally toward the opposite thigh; this lifts the child's breech off the brim and into the cavity of the pelvis.

In shoulder cases further assistance may be rendered by *external* upward pressure of the head. The internal repression must be made with *extreme caution*, to avoid laceration, etc. By grasping the arm near the elbow, the shaft of the humerus may be used to make upward pressure in the glenoid cavity of the shoulder. When the presenting part, whatever it may be, will not recede sufficient to admit the obstetrician's hand, placing the woman in a *genu-pectoral* posture will be serviceable. No case should be considered impossible until this posture has been tried. Again, by placing the woman in a squatting posture (provided there be no contra-indication to it, as might occur from great exhaustion, etc.), the pressure of her own thighs upon the abdomen may lift both womb and child, and thus secure the desired recession of the presenting part. Should all efforts fail, embryotomy becomes the only resort; or if the child be alive and the mother in good condition for the operation, symphyseotomy may be done.

After turning, *extraction* may be difficult. Traction on the lower extremities should be made slowly when the soft parts

are not yet dilated. It is unnecessary to attempt to aid rotation of the hips; the leg that is down will spontaneously come to the pubes. When hips begin to emerge elevate leg or legs toward pubes, that the posterior hip may escape first at the perineum. In grasping the child's body after delivery of the breech, grasp *its pelvis*, not the soft structures above, which might injure the viscera of the abdomen. The hips and the abdomen having been delivered, the arms come next.

Extraction of the Arms.—Delay with the arms (as with the after-coming head) is fatal to the child often within ten or fifteen minutes; hence different methods of extracting arm should, if necessary, be tried in rapid succession.

Arms Flexed.—Normally, arms *remain flexed* on chest, the elbows pointing down toward the breech. Here delivery is usually easy, thus: rotate body of child to bring one shoulder to pubes, the other to sacrum; pass in the hand whose palm corresponds to the child's abdomen up to the chest, seize the forearm, as near the wrist as possible, and pull it down, the delivered portion of the child's body being meanwhile lifted up and toward its back, thus giving more space for the operator's hand over the abdomen. Posterior arm to be delivered first.

Arms Extended.—In version cases when traction is made on breech, arms get displaced; they catch against sides of pelvis and become extended, and point straight up alongside of the head. *Often very difficult to deliver.*

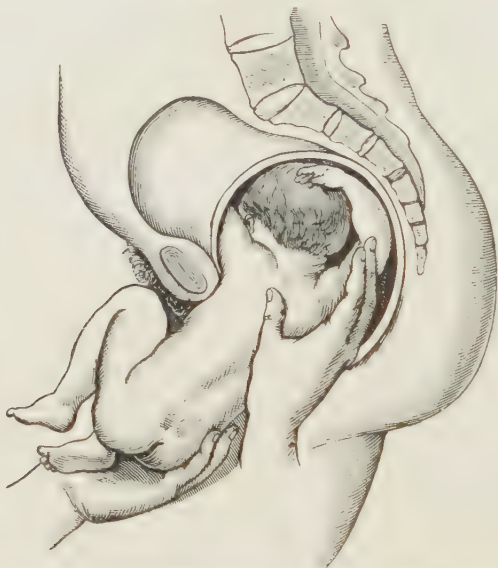
Treatment: With one hand lift the legs and body, as far as possible, upward over the pubes, and to one side; this will aid the posterior shoulder to descend and give room for the *whole hand* of the operator to pass into the vagina along the *back* or *side* of the child, until two fingers reach the posterior shoulder, and then slide along the arm to the *elbow*, which is pushed across the child's face and brought down over its chest. If the fingers cannot reach the *elbow*, place one of them lengthwise, on each side of the arm (where they act as splints to prevent fracture) and push humerus across face and chest, as before. (Fig. 196, page 394.)

If this effort to deliver with the hand passing in along the *back* or *side* of child fail, withdraw the hand without delay, lift the child's body toward the opposite side (but still upward over pubes) and pass hand in along *abdomen* of child, until

two fingers reach elbow and hook it forward over face and chest, as before stated. If time allow any choice, the hand should be passed in between the pains.

The *posterior* arm having been delivered, the other—directed *anteriorly* toward the pubes—must be extracted, thus: In some cases depress child's body, as far as possible, toward perineum and to one side, while the operator's hand passes in, either along *back* or *abdomen* (try both if one fail) until reaching *elbow*, which is drawn by two fingers across face and chest and brought out under pubes. (Fig. 197.)

FIG. 196.



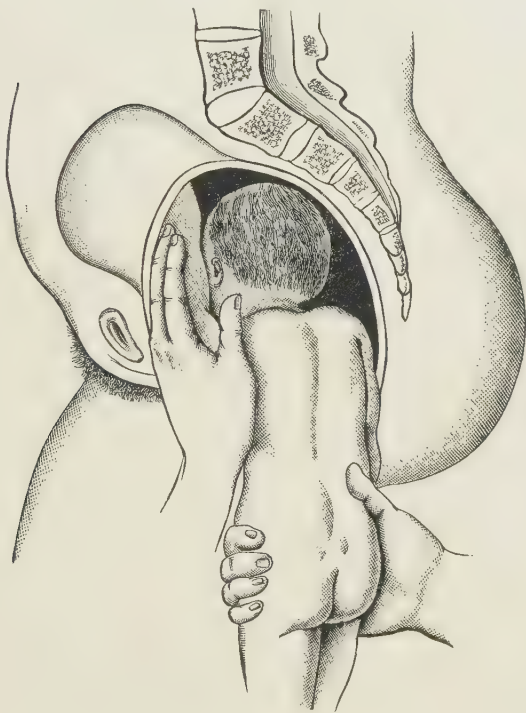
Delivery of posterior arm when extended. (JEWETT, after A. R. SIMPSON.)

Another plan: Instead of trying to extract anterior arm under pubes, or having failed after trial, rotate undelivered arm to sacrum, where there is more room, and deliver as if it had been originally posterior. This rotation is accomplished by seizing released arm and drawing it up along one side of the pelvis, from the sacrum to the pubes; the shoulder inside

follows the movement and goes to the sacrum, when it is delivered in the same way, but more easily than the first one.

Shoulders Transverse.—Instead of rotating into antero-posterior diameter, shoulders sometimes remain transverse.

FIG. 197.



Delivery of anterior arm when extended. (JEWETT, after A. R. SIMPSON.)

Treatment: Grasp thorax in both hands and rotate one shoulder to front, one to rear. Failing in this, if back be toward pubes, lift body upward and pass hand along abdomen to seize elbow, and bring it down across face, etc. If back of child be toward sacrum, the arms, if *flexed*, may be drawn out under pubes; if *extended*, this will be difficult or impossi-

ble. Try, then, to pass hand back of child and draw elbow *backward* and *downward* along and below side wall of pelvis, then *push* forearm over *thorax* and draw it down.

FIG. 198.



FIG. 199.



Dorsal displacement of the arm.

Dorsal displacement of the arm, as shown in Figs. 198 and 199, may occasionally complicate extraction. This may occur in *two ways*: The arm having been *extended* alongside of head, the elbow becomes bent, throwing forearm behind neck, below occiput, where it catches upon brim of pelvis and arrests progress. It is caused by rotating the child's body, the arm failing to follow this rotation, and is *treated* by rotating the child's body in the opposite direction to the rotation that produced the displacement.

It may also occur from the same cause when the arms remain *flexed* across the chest, and is *then* relieved by passing in the hand along the back of the child and grasping the elbow, which is pulled *downward* and *forward*; or simply hook a *finger* in the bend of the elbow and push or sweep it laterally and forward over the child's face. In the case shown in Fig. 198 the finger would thus sweep the elbow and forearm toward and over the *right* ear and side of the head, until it got them in front, over the face and chest. When it occurs with the arm *flexed*, the scapula will be found *near* the spinal column; when occurring with *extension*, the scapula will be forced *away* from spine; hence diagnosis of methods to be used.

In version cases, after extraction of the shoulders, the after-coming head is to be delivered by the methods already described under "Breech Presentation" (pages 326-337).

CHAPTER XX.

CUTTING OPERATIONS ON THE MOTHER.

THE cutting operations on the mother are: Symphyseotomy; Cæsarean Section; Porro's Operation; the Porro-Müller Operation; Cœliotomy; ¹ Cœlio-elytrotomy.¹

SYMPHYSEOTOMY (SIGAULTIAN OPERATION).

An operation invented by Sigault for enlarging the pelvis by dividing the symphysis pubis and separating the pubic bones from each other. It was first practised on the living woman by Sigault in 1777.² Since that time the operation has been regarded at different periods with alternating favor and opposition in European countries, but was never performed in the United States until 1892. In September of that year attention was called anew to the good results obtained by improved methods of doing the operation under antisepsis by Robert P. Harris, of Philadelphia, and subsequently the utility of the proceeding has been practically demonstrated in this and other countries, and is now generally recognized.

When the symphysis is divided during labor the pubic bones spontaneously separate from each other to the extent of an inch or more; they open like a pair of folding doors, of which the sacro-iliac synchondroses represent the hinges; by separating the woman's lower limbs the gap may be increased to two, two and a half, or even three inches, but so wide a separation as three inches is not usually advisable or necessary. Should either of the sacro-iliac joints (hinges) be ankylosed, and consequently immovable, the operation cannot be done successfully, and is contra-indicated. The child

¹ The term Cœliotomy (from *Koilia*, the abdomen) has been lately substituted for Laparotomy (from *Lapara*, the flank or hollow of the waist). Common usage still accords a similar meaning to both terms. Cœliotomy is the more correct.

² J. C. de la Courvée, a French physician, operated on a *dead* woman to save the child in 1644.

is delivered, usually by forceps or version, immediately after division of the pubic joint. Less frequently the natural powers are sufficient to accomplish delivery.

After division of the symphysis the pubic bones not only separate *laterally*, but the two halves of the now divided pelvis (more exactly the two innominate bones), owing to the peculiar structure of the sacro-iliac synchondroses, have also an *anterior dip*; they go down a little in front, toward the perineum, thus moving the anterior wall of the pelvis farther from the sacral promontory; the line of the conjugate diameter of the brim becomes more slanting, more like the "diagonal" conjugate, and is thereby lengthened. This descent in the anterior part of the innominate bones is farther increased by pressure of the head during labor.

Cases Suitable for the Operation.—(1) *Contracted pelves*, in which the true conjugate diameter measures between two and three-quarters and three and one-quarter inches (7 to 8.2 cm.)—the pregnancy having, of course, reached full term. By separation of pubic bones the conjugate is lengthened *about* half an inch, while a farther gain of *about* one-fourth of an inch is required by the presenting part protruding into the gap between the divided bones. In "*flattened*" pelves, in which the transverse diameter is relatively wide, the lower figure (two and three-quarter inches) may, after symphyseotomy, admit a living child to pass. In "*generally contracted*" pelves the higher figure (three and one-quarter inches) will be more necessary. In both kinds of pelves symphyseotomy produces also enlargement of the transverse and oblique diameters. In fact, these two diameters are lengthened *more* than the conjugate; thus, when the pubic bones separate two and three-quarter inches, the conjugate will be increased half an inch, the oblique one and one-third inches, and the transverse one and one-fifth inches or thereabouts.

(2) Cases in which the child is *unusually large*, or in which it has become *impacted* from faulty mechanism, as in *arrested mento-posterior* positions of face cases, and *occipito-posterior* positions of head presentations. Also arrested cases of breech or shoulder presentations when usual methods of delivery fail.

(3) It is evident that conditions mentioned under headings (1) and (2) may coexist and still be suitable for the operation, but with less prospect of success in some instances.

In order that the operation shall succeed, certain other conditions should be present in every case, viz.:

(a) The os uteri and os vaginæ must be *sufficiently dilated* to allow rapid delivery after symphysis is divided; or *sufficiently dilatable* to allow rapid dilatation artificially.

(b) The child must be not merely *alive*, but so far *uninjured* by delay, or by previous attempts to deliver, as to give it every chance to survive after birth.

(c) The *mother* should be in *good condition*; neither exhausted by delay and exertion, nor injured locally by fruitless attempts to deliver by other methods. She must be free from septic infection. Should the uterus be already, infected a Cæsarean section with hysterectomy, that is, a Porro operation, would be the proper proceeding, not symphysectomy.

The operation is *contra-indicated* when there is ankylosis of either sacro-iliac joint (hence in the oblique pelvic deformity of Nægele, and Roberts' pelvis); in all cases when the conjugate is *less* than two and three-quarter inches—presuming the child to be full-sized; in cases of bony, cancerous, fibroid, or other tumors occupying the pelvic canal, etc. Ankylosis of the pubic joint itself does *not* necessarily contra-indicate the operation—a chain-saw being in readiness to cope with this difficulty.

Dangers of the Operation.—Hemorrhage from the wound; laceration or other traumatism of bladder, urethra, and vagina, and subsequent fistulæ; impaired locomotion from faulty union of pubic bones and injury to sacro-iliac synchondroses; septic infection of wound. All of these have occurred; but improved methods of operating are gradually reducing the frequency of their occurrence. While the maternal mortality during the last few years has been about 12 per cent., more recent results, owing to improved *technique* and making the operation an “elective” one instead of a last resort, show a diminished mortality and indicate that in future the death-rate may be reduced to *nothing* under favorable circumstances. The *infant mortality* is not increased by, but largely depends upon the conditions preceding the operation.

Instruments, Assistants, etc.—One assistant to give the anæsthetic; one to hold a catheter in the urethra, and otherwise aid the operator; a nurse to take charge of the child;

another assistant may be advisable to secure uterine contraction and retraction, and delivery of placenta.

The *instruments* necessary are a scalpel; a probe-pointed bistoury (the latter in place of Galbiati's or Morisani's knife); a dissecting forceps; half a dozen artery forceps; needle-holder and curved needles; a metal female catheter; a chain-saw; sutures of silk or silkworm-gut; iodoform gauze; ligatures; strips of adhesive plaster two or three inches wide, long enough to go round the pelvis; a strong binder or abdominal bandage of inelastic material; together with iodoform and the usual materials for antiseptic dressing, and a pair of obstetric forceps.

Operation.—The method of operating is still undergoing revision, necessary modifications and improvements in its *technique* have been added during the past few years. The pubes, labia, and perineum are shaved, and together with the abdomen, thoroughly disinfected with soap and water, bichloride solution, ether, etc., as in any abdominal section. The vagina also is thoroughly sterilized with a bichloride solution 1 : 2000. The woman is anesthetized and placed on her back near the edge of the bed. Some operators stand by her side; others prefer to be in front between her lower limbs.

The bowels must, of course, have been previously emptied and the bladder catheterized immediately before commencing the operation, when it will also be advisable, by a final auscultation, to ascertain *positively* that the child is still alive.

There are *two ways* of doing the operation, *first*, the “closed” or “*subcutaneous*” method, with a *short* incision; *second*, the “open” method with a *long* incision. Each has its advantages and disadvantages; some operators prefer one, some the other. The *closed* method with *short* incision is generally preferred, as will presently be seen; it entails less danger of septic infection of the wound from the lochia, and less risk of hemorrhage.

Subcutaneous Method, with Short Incision.—In the median line of the abdomen, an incision is made one and one-half inches long (some make it *one*, others *two* inches) the *lower* end of which is half an inch *above* the upper end of the pubic symphysis. Cut through skin and fascia, down to the recti muscles. The attachments of these muscles are separated from the posterior surface of the symphysis and pubic

rami with the finger, which is passed down behind the joint until it can be hooked under the pubic arch. The assistant now passes a metal catheter into the bladder and holds the urethra backward toward the right side, to keep it out of the way while the joint is being divided.

The sickle-shaped knife of Galbiati (Fig. 200), or what is just as good (or better in some cases) a probe-pointed, slightly curved bistoury, is passed down, guided by the finger behind the articulation, and hooked under the subpubic ligament, when the cartilaginous and ligamentous tissues of the joint are cut from behind forward and from below upward, until the bones separate—sometimes with an audible crack. The joint is not *obliged* to be severed in this particular manner. The point of the bistoury may be guided by a Hay's director (previously introduced) instead of the finger; or, again, the

FIG. 200.



Galbiati's knife for symphyseotomy.

bistoury *alone*, its point kept closely in contact with the articulation, may be passed down, guided by a finger of the other hand in the vagina. Again, the joint *may* be severed from above downward and from before backward, a lead plate, or tampon of iodoform gauze having been first placed behind the joint, to prevent injury of the retro pubic tissues.

Note that the *subpubic ligament*, as well as the interarticular cartilage, must be divided, or the bones will not separate satisfactorily. There is a plan, however (devised by Harris, of Chicago) in which the subpubic ligament is intentionally left *un-cut*; instead of cutting it in the middle he separates its central and lateral attachments to the pubic arch (together with those of the perineal fascia) with a blunt-pointed bistoury, closely "hugging" the bone, under guidance of the finger. Numerous advantages are claimed for this method.

The joint having been divided, the wound is packed with iodoform gauze and covered with a compress wet with bichloride solution, while the child is delivered, either by labor pains alone, should they be strong enough; or by forceps, if the head have already engaged in the pelvic brim; or by version, if it be yet *above* the brim. The child having been delivered is handed to an assistant or trained nurse, who should have previously prepared bowls of hot and cold water, etc., to secure its resuscitation, should this be required. The placenta is delivered by expression in the usual manner. During delivery of the child, pressure on the trochanters must be made by assistants to prevent too wide separation of pubic bones.

Open Method of Operating, with Long Incision.—An incision is made in the median line three or four inches long, beginning half an inch or an inch above the upper end of the symphysis, and ending at the root of the clitoris, or a little on one side of it.

These tissues are cut down to the joint, and the incision then continued through the cartilage of the joint itself, the symphysis being thus severed from before backward and from above downward. The precautions to prevent accidental injury of the urethra, bladder, etc., are the same as when operating by the subcutaneous method, by short incision.

Delivery of child and placenta accomplished, the iodoform gauze tampon and sublimate compress are removed. The wound is cleansed with bichloride solution, hemorrhage arrested, and the incision closed by sutures. It is *not* necessary to suture the bones or cartilages. A catheter is used, as before, to keep the bladder, urethra, or vagina from being nipped and pinched between the two pubic bones while the latter are being continuously held in apposition by assistants making pressure upon the trochanters while sutures are being passed. The sutures (of silk or silkworm-gut) may advantageously pass through the fibrous tissues on the anterior aspect of the pubic joint. In very fat women a separate running catgut suture may be used to unite the recti muscles, before the superficial ones are put in. Antiseptic dressing is applied to the wound and kept in place by adhesive strips; while over this is placed a strip of strong rubber adhesive plaster, three or four inches wide, going over the trochanters

and completely round the pelvis, to keep the bones immovably in apposition. Lateral pressure by the assistants must be unremittingly continued until immobility of the bones is secured by the completion of the dressings just described. The rubber adhesive plaster may be reinforced by additional support of an ordinary muslin bandage. All sorts of devices—canvas belts with straps and buckles, Esmarch bandages of solid rubber, a wire cuirass, padded plates, special beds, sand-bags, etc.—have been used to secure immobility of the bones, but the strip of rubber plaster is always available, and its efficiency has been demonstrated by numerous operators.

An antiseptic absorbent pad, or a complete "*occlusion dressing*" (see page 268) should be applied to the vulva, and as a further security against sepsis, the vagina may receive a tampon of iodoform gauze.

The woman must remain on her back for two weeks, her lower limbs being stretched out straight and the knees lightly tied together. During the third week she may turn on her side, and at the end of a month sit up. The pelvic bandage should be worn six weeks or more. The dressing upon the wound (which must of course be kept separate from the usual vulvar pads) may remain untouched for five days, there being no indication of suppuration and no contamination from the lochia.

Especial care should be taken to keep the external genitals and adjoining parts aseptically clean by washing them two or three times daily with a mild bichloride solution while a bed-pan is placed under the nates. The lower limbs (still tied together) may be lifted straight up, thus exposing the genitals for these ablutions without separating the feet.

Ayers' Operation.—A third method of operating, devised by Edward A. Ayers, of New York, has been recently practised with success, and promises well. In contra-distinction to the "subcutaneous" method, it might be called "submucous," for no wound is made in the *skin*. It is as follows: The vulva, vagina, etc., having been made aseptically clean, the patient, on her back, is brought to the edge of the bed and the thighs flexed. The bladder and urethra are drawn to the left by a urethral sound, while clitoris and labia minora are drawn upward and to the left. The operator's left index finger now enters vagina and passes up

along posterior groove of symphysis until reaching the *top* of the joint. A small incision, beginning half an inch below the clitoris, only long enough to admit easily the blade of a bistoury, is made over and down to the articulation. A blunt-pointed bistoury is then pushed up along the anterior face of the symphysis, *under* the vessels of the clitoris, until the point of the instrument can be felt over the *top* of the joint by the tip of the finger in the vagina. Guarded by this finger, the blade of the bistoury is now worked down through the articulation, cutting from top to bottom. To sever the subpubic ligament the direction of the bistoury may be changed, so as to cut from below upward. The finger in the vagina easily determines when the bones separate and the distance between them. Delivery, etc., as in the other methods.

The little wound is packed lightly with iodoform gauze (to be removed in thirty-six hours); covered with a gauze dressing (no suturing required); while vagina and vulva are kept clean by bichloride irrigation. Catheterism (the wound being above the *meatus urinarius*) may be done, if necessary, without infection.

Difficulties during Operation.—Hemorrhage from the wound may be controlled by ligature if possible, especially if arterial; venous oozing by a tampon of iodoform gauze stuffed in the wound, with counter-pressure by the fingers in the vagina.

There may be difficulty in finding the joint; it is not always centrally placed, nor always straight. By moving one lower limb of the woman while the operator's finger is in position, the motion of one side will thus reveal the situation of the symphysis; or shallow exploratory punctures over the joint may be made with the point of a knife, until it strike the yielding cartilage between the bones.

In case the joint be ankylosed, a chain-saw may be passed down behind and up in front of the articulation, and the junction sawed in twain.

Accidental incision or laceration of the urethra or bladder should be sutured with fine silk. If the wounds fail to unite, a secondary operation may be needed after the puerperal period is over.

The presenting head of the child may be jammed so closely against the pubic bones as to interfere with the operation.

The presenting part should be pushed up out of the way, and, if space cannot then be obtained for the bistoury to cut from the back of the symphysis forward, the incision must be made from before backward.

It may be observed, when the pubic joint is severed, that the two innominate bones at the site of separation are *not* on the same level; one is lower and farther from the median line than the other. This should be corrected by gentle pressure or traction upon the higher half of the divided structures; otherwise the pubic separation may take place at the expense of one sacro-iliac joint more than the other, and cause more injury to the sacro-iliac structures than if both were moved equally.

Finally, be it remembered that whatever the method of operating, symphyseotomy is done for the most part in the interest of the *child*, and is designed chiefly to supplant craniotomy and other methods of forcible delivery by which the life of the infant is jeopardized and sometimes lost.

The utility of combining symphyseotomy with the induction of premature labor in cases of contracted pelvis has not yet been positively demonstrated.

In certain cases, when the *child is dead*, symphyseotomy combined with embryotomy may be resorted to, in the *interest of the mother*. In practice these cases have not yet been definitely settled. Theoretically, when the pelvis is so much contracted that the danger to the mother of a difficult craniotomy *alone* is so far reduced by symphyseotomy that the reduction is greater than the additional risk incurred by the latter operation; or, again, should it be possible to obviate the greater danger of abdominal section by combining embryotomy with symphyseotomy, the latter operation would seem to be indicated. These are matters for future decision.

CÆSAREAN SECTION (FORMERLY GASTRO-HYSTEROTOMY; LATER LAPARO-HYSTEROTOMY; MORE RECENTLY CELIO-HYSTEROTOMY).

An operation which consists in cutting through the walls of the abdomen and uterus and delivering the child and placenta through the incision, after which the uterine and abdominal incisions are closed by sutures. Since no part of the uterus

or any other maternal organ is removed during the operation, the proceeding is known as *conservative* Cæsarean section, in contradistinction to another operation known as the *radical* Cæsarean section, in which, after extracting the child as above described, the uterus itself is taken out; either amputated through the cervix or taken out entirely, cervix and all. The radical operation devised by Porro is known as the "Porro operation" or "Porro-Cæsarean section." Again, since the older, *conservative* operation was much improved by a special method of suturing the uterine incision devised by Säger, it is now sometimes called the "Säger-Cæsarean section." So, once more, the Porro operation was modified by Müller, hence the "Porro-Müller operation." These names (and others might be added) are chiefly of *historic* interest; they represent stages in the progressive improvement of the operation from what it *was* to what it *is* at the present time. Having understood their meaning, the student may dismiss them; but let him remember that out of the confusion of the past there have been evolved *two distinct operations*, which survive as the recognized best methods of operating at the present time. These are first, the *conservative Cæsarean section*, and second, the *radical Cæsarean section*, both of which will now be considered with some detail.

The Conservative Cæsarean Operation.—Indications.—The cases in which it is performed are: (1) *Extreme* deformity of the pelvis, in which delivery by forceps and version is excluded, and in which craniotomy is either impossible or would be more dangerous to the mother than cutting into the abdomen and uterus; and in which there is not room for a successful symphyseotomy. Such cases present the "*positive*" indication for Cæsarean section; there is nothing else to be done. Flat pelves having a conjugata vera of $2\frac{1}{4}$ inches or less (5.5 cm.), and justo-minor pelves with a conjugata vera of $2\frac{1}{2}$ inches or less (6.3 cm.) present this positive indication; (2) cases of more moderate pelvic contraction in which craniotomy is possible, but Cæsarean section is agreed upon to *save the life of the child*; (3) mechanical obstruction in the pelvis from fibroid, cancerous, bony, or other tumors which cannot be pushed up out of the way or be safely removed; (4) irreducible impaction of a *living* child in transverse presentations;

(5) in women dying near the end of pregnancy the child, if alive, is rapidly delivered by *post-mortem* Cæsarean section; (6) various other obstructions from inflammatory adhesions, atresia, constrictions, etc., of the vagina, and uterine displacements, may rarely require the operation; (7) recently the operation has been done in eclampsia cases, where more conservative methods of rapid delivery were impracticable; and (8) in placenta prævia, chiefly with a view to lessen the infant mortality attending the usual treatment of this complication.

Contra-indications.—When the *positive* indication exists (as in the cases of *extreme* deformity, first above mentioned) all contra-indications of course vanish; the operation must be done in spite of everything. When the indication is "*relative*," viz., when something else (usually craniotomy) *can* be done, the Cæsarean section is contra-indicated: (1) when the child is dead or dangerously near it; (2) when the mother is so far exhausted that the operation would be likely to kill her; (3) when the mother is already infected, or has been subjected to unclean (unsterile) examinations which render it almost impossible that she should escape infection; (4) when the surroundings of the patient are such as to make the technique of an aseptic operation impossible. Under these circumstances craniotomy should be done; unless the woman and her relatives prefer to run all risks for the sake of the living child. Further, if they so decide in any case of *infection*, the *radical* operation (taking out the infected uterus) should be done instead of the *conservative* Cæsarean section.

Prognosis and Danger.—Death may result (1) from *hemorrhage* during or after the operation; (2) from *shock*, especially in women greatly exhausted; (3) from *peritonitis* and *metritis*; (4) from *septicæmia*. The percentage of maternal recoveries, as deduced from statistics, is notably unreliable. The figures usually include *all* cases, alike those who die *after* the operation and those who die *on account of* it. The result depends more on the conditions preceding, attending, and following the operation, than upon the operation itself. Not long ago the results of so-called "*cattle-horn Cæsarean section*" (cases in which pregnant women were torn open by the horns of infuriated animals) were more favorable than cases operated upon by surgeons, for the reason that the cattle were goring healthy women, while the surgeon was operating on women

exhausted by long labor and with tissues injured by unsuccessful attempts to deliver by forceps, version, etc. While the mortality *used to be* 50 per cent. or more, it has of late been so far reduced by improved methods and knowledge, that by "a recent analysis of the literature of the world, conducted with the idea of determining the prognosis of this operation under favorable conditions, it was discovered that up to August, 1888, thirty-nine Cæsarean sections had been performed by thirty operators," with the result that *all* the mothers recovered and thirty-eight children were saved;¹ and this even though most of the operators were doing the operation for the first time.

From later statistics given by Reynolds and Newell, in their 1902 work, we find that in 100 *favorable* cases of simple Cæsarean section there were only 2 deaths, and these two occurred years ago, presumably from defect in the aseptic technique, which improved modern methods could well prevent. Of the 100 favorable cases, the authors give 26 of their own, in which there was *no* death. In *unfavorable* cases (from delay, infection, exhaustion, etc., before the operation), however, the mortality reached 5 in 21 cases—24 per cent. These authors therefore conclude that the operation performed on favorable cases has only a very insignificant mortality, but that in *unfavorable* ones the mortality is so great as to render the operation almost unjustifiable.²

A table compiled by Williams (quoted by Webster³) gives 162 cases by 6 operators, with 5 deaths; a mortality of 3.08 per cent.

The *best* results are obtained by making the operation a so-called "*elective*" one—that is to say, the obstetrician (having previously ascertained the advisability of the operation) *elects* a favorable time, place, etc., for its performance, instead of doing it by compulsion under adverse circumstances, when other methods of delivery have failed; which simply means, do it near the end of pregnancy, *before labor begins*; elect the time and place; secure assistants, nurses, instruments, dressings, and prepare the patient by previous treatment, etc. These things *cannot* be so well done during the sudden emergency of labor, especially at night.

¹ Edward Reynolds: Practical Midwifery, page 197. First Edition, 1892.

² Reynolds and Newell: Practical Obstetrics, page 269 (1902).

³ Webster's Obstetrics, page 711 (1903).

Since surrounding circumstances and existing conditions so far vary that no two sets of cases are exactly alike, statistical results must vary also, and figures can therefore give only approximate indications for future guidance.

Unfavorable conditions, such as the atmospheric impurities of hospitals; previous exhaustion (both of woman and womb) from protracted labor, or coexisting disease; previous injury from unsuccessful attempts to deliver by version, forceps, etc.; bungling from lack of skill during the operation; neglect of *aseptic* precautions; and injudicious after-treatment, have largely increased the death-rate. To be successful, the operation should not be put off as a last resort, but performed early, the conditions requiring it having been made out, if practicable, at or before the beginning of labor.

Preparation for Operation.—If practicable, let the patient avoid solid food for twenty-four hours before the operation. Empty bowels and bladder. Shave the hypogastric region, pubes, etc. Scrub the abdomen with soap, water, and brush; then wash it with ether, and then with a mild bichloride solution (1:3000), and douche the vagina with the last-named solution. Should there be time the abdomen may be covered during the twenty-four hours preceding the operation with a sterile towel wrung out of a 1:1000 bichloride solution, over which goes a thick layer of sterile cotton and a binder.

During the operation all parts of the limbs and body except the field of operation must be protected from cold by sterile towels or some other light covering.

Instruments, etc.—The following instruments are required (I quote directly from Williams' *Obstetrics*, page 404, viz.: "One scalpel, one long blunt-pointed scissors, two dissecting forceps, twelve short and six long artery clamps, an abdominal retractor, a needle-holder, and appropriate needles, as well as the usual sterile dressings, suture materials, and gauze sponges."

Besides the other numerous requirements usual for a surgical operation, there should be in readiness a *separate table* with appurtenances for resuscitating the child.

Assistants.—First, the chief assistant to help the operator; second, one for the anæsthesia; third, one to take care of the child; fourth, one to hand instruments; and a fifth ready for

anything the operator may desire. The assistants should receive specific instructions before the operation, as to what they are to do.

Owing to the *great* danger of *prolonged* delay in obtaining instruments, assistants, antiseptics, etc. (as may occur in country practice), it may well be questioned whether it would not be better to do the operation with a knife, needles, and sutures, using boiled water for aseptic cleanliness, and having "one physician and a few women" for assistants, rather than waste *very much* time waiting for better appliances.

Operation.—The operator stands on the right side of the patient, who should rest on a high, firm table, with her shoulders slightly elevated and the lower limbs moderately flexed. The chief assistant, standing on the left and facing the patient's feet, steadies the uterus in the median line and produces moderate tension of the abdominal wall over it by pressing the ulnar border of each hand down on the sides of the uterus while his thumbs rest on the fundus. The incision is then made in the median line. The *length* of this incision depends upon the method of operating selected. There are really *two* methods: *one* with a *short* abdominal incision of four or five inches, during which the operator will take out the child while the womb *remains in the abdominal cavity*; and *another* with a *long* abdominal incision of seven or eight inches, in which the uncut uterus is brought *outside of the abdominal wall before* it is incised and the child extracted.

Most operators nowadays prefer the long incision of about *seven* inches, through which the uterus may or may not be delivered before being cut. Should there be reason to suspect the uterine contents are infected, the organ *should* be delivered through the incision before it is opened, in order that it may be securely packed around with sterile gauze, and thus the better prevent infected matters from the uterus getting into the peritoneum. Should there be no infection of the uterine contents, the womb may remain in the abdomen, sterile gauze pads being nevertheless packed in between the uterus and abdominal wall, the latter meanwhile being pressed against the uterus by the hands of an assistant, so as still to prevent liquor amnii, etc., getting into the peritoneum when the uterus is incised.

The incision is made in the median line of the abdomen, not between the umbilicus and pubes as was formerly done,

but higher up, one half of the cut being above, the other half below the umbilicus, this last being, therefore, its central point. Bleeding vessels in the abdominal incision are secured by clamps.

The uterus is now visible; it is incised in its median line, either within or outside the abdomen, as stated in the preceding paragraph. If it is to be delivered through the abdominal incision before being cut, this delivery (not always easy) may be facilitated by rotating the uterus so as to bring the side (or cornua) of the organ toward the abdominal opening. If it is to be cut while remaining in the abdominal cavity, care should be taken to manipulate the uterus (if it lie obliquely) in such a manner as to bring its median line in the centre of the abdominal opening. The uterine incision is begun with a scalpel at the lower end of the abdominal incision, and finished with scissors to the requisite length of six or seven inches, cutting up toward the fundus. The membranes (if intact) are now ruptured, and the child seized usually by a foot and extracted. The cord is clamped in two places, between which it is cut, and the child taken by an assistant.

There will usually be some hemorrhage from the uterine incision, but not much, if the uterus contract promptly, and the operator be sufficiently expert to complete the part of the operation thus far described within two minutes, which can often be done. Encircling the lower part of the uterus with a rubber tube to constrict its vessels and prevent hemorrhage (which used to be done) is unnecessary and inexpedient. Should there be too much bleeding, the vessels may be temporarily compressed by the hands of an assistant over the lower segment of the uterus. If the placenta happen to be in front, go on and cut through it without delay, or separate and push aside that part of it which overlaps the incision, and extract the child quickly. Now compress the uterus and secure its contraction, and if it were incised within the abdomen, it is now (easily) brought outside, surrounded by warm wet sterile gauze or sterile towels which also cover the abdominal incision—this last to be temporarily held together by artery clamps at its upper end, above the uterus. Next the placenta is delivered by manual expression through the incision, or if this fail, the hand is passed inside to separate and extract the placenta and membranes. Before the hand

is finally withdrawn from the uterine cavity, a finger should be passed to the cervix to ascertain that nothing obstruct its cavity. Some operators carry a strip of iodoform gauze into the uterus, and push one end of it through the cervix into the vagina, whence it may be drawn out the next day. Others consider this unnecessary. So some disinfect the uterine cavity by irrigation with an antiseptic solution; others do not.

The next step is *suturing* the uterine incision. This requires special care. It was the Sanger method of closing the uterine wound that so greatly diminished the mortality of the operation. There are many modifications of his original plan, but the purpose of them all is the same, viz., to secure so firm and perfect a coaptation of the uterine incision as to prevent bleeding, and also to prevent the entrance of lochial matters from the uterine cavity into and through the incision into the peritoneum.¹

The modern method of suturing is as follows: *First*, a set of *deep* interrupted *silk* sutures which enter one fourth of an inch ($\frac{1}{2}$ cm.) from the edge of the wound, penetrate peritoneum and muscular coats, down to, but not into the mucosa, then enter the opposite side just clear of the mucosa and emerge one fourth of an inch from the edge of the wound on the peritoneal surface. These deep sutures are placed about half an inch apart. It is well not to tie the first one until three have been put in. Then put in the fourth and tie the second, and so on all along. This enables the operator to easily explore the cut surfaces and see exactly where his needle is going, which he could not so well do if the sutures first put in were immediately tied.

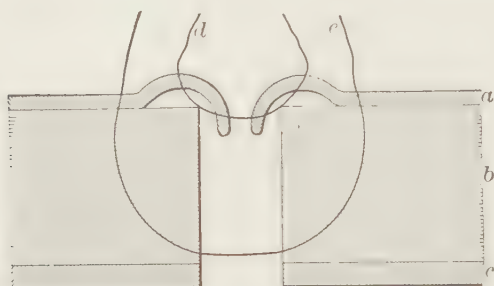
Hirst leaves *all* these interrupted sutures *untied* until he has passed two tiers of a running catgut suture through the muscular coat *alone*; the interrupted silk sutures *are* tied, thus completely concealing the running catgut suture in the muscular wall. The method is excellent, but it requires time and skill, and is not generally adopted.

The *deep* sutures having been tied, another set of *superficial* catgut (one between each two of the deep ones) are put in, passing only through the peritoneum, or embracing a few fibres

¹ It now seems incredible, but is nevertheless true, that within the last fifty years, if the uterus contracted well, it was not deemed necessary to put *any* sutures in the uterine wound. No wonder that many died from leakage of infected lochia into the peritoneum and septic peritonitis.

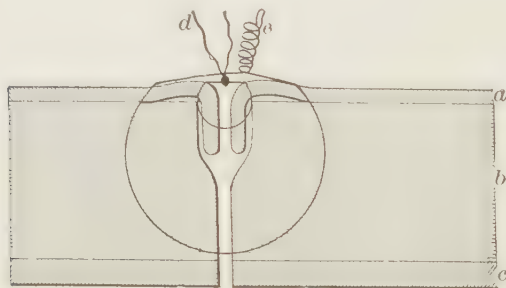
of the muscular coat. Sanger originally pared off a little strip from the outer edge of the muscular coat and turned in the borders of the peritoneum, as shown in Figs. 201 and

FIG. 201.



Showing position of sutures in relation to structures in uterine wall. *a.* Peritoneum. *b.* Uterine muscle. *c.* Decidua. *d.* Superficial suture. *e.* Deep sutures. (After GALABIN.)

FIG. 202.



Showing the sutures when tied; peritoneal surfaces being brought into contact by the superficial sutures. *a.* Peritoneum. *b.* Uterine muscle. *c.* Decidua. *d.* Superficial sutures. *e.* Deep suture. (After GALABIN.)

202. This, however, takes too much time, and is unnecessary; the peritoneal surfaces may be brought together just as well

by using the Lembert stitch, which is now generally preferred.

The second set of sutures having been placed (as described), any additional ones may be put in, irregularly, through any bleeding or gaping point along the line of incision, where pressure with the finger or a hot compress fail to stop oozing of blood.

It only remains to cleanse the peritoneal cavity with sterilized gauze of blood clots or other matters, replace the uterus, draw down the omentum into its natural position, and close the abdominal wound by sutures in the usual way, the peritoneum, muscular wall, fascia, and skin being brought together in separate layers.

The wound is covered with a dry antiseptic dressing, kept in place by adhesive strips and a binder.

So much for the "*conservative*" operation; we have next to study the "*radical*" Cæsarean section.

THE PORRO OPERATION (CÆLIO-HYSTERECTOMY), RADICAL CÆSAREAN SECTION.

This operation, as now performed, may be briefly defined as a Cæsarean section, in which, after the child has been taken out through the uterine incision, the uterus itself is removed. It is either amputated above the vagina, leaving a cervical stump, or taken out entirely, cervix and all. Sometimes, not always, the ovaries and tubes are removed also. Reasons for this will be stated further on.

Indications.—Broadly speaking, the indications for the operation, with regard to pelvic measurements, etc., are the same as stated for the conservative operation (see page 407). But the question now is, in what cases of Cæsarean section should the operator go further and remove the uterus. The cases are these: 1. Uterine tumors: fibroma, myoma, cancer, etc. In cancer cases, of course, the *whole* uterus should be removed, cervix and all. 2. Cases of *complete inertia* of the uterus, the organ failing to contract, thus endangering death from hemorrhage. 3. When the uterus is infected. 4. In bad cases of uterine rupture with jagged and irregular tears that cannot be perfectly brought together by sutures. 5. In cicatricial narrowing of the parturient canal which would obstruct the

lochial discharge. 6. In cases of *osteomalacia*, apart from the pelvic deformity resulting from this disease, which may require abdominal section, removal of the uterus and ovaries arrests the disease of the bones, which the conservative Cæsarean section would not. 7. In any case of pelvic deformity when it is desired to unsex the woman and thus *prevent a future pregnancy*.

Operation.—The original operation, as done by Porro, which consisted in amputating the uterus through the upper part of the cervix and suturing the cervical stump into the lower end of the abdominal wound, is so *seldom done at present* that it will here receive only brief attention. Observe that the *purpose* of the operation was to keep the raw surface of the cervical stump exposed outside the skin, so that no hemorrhage or infecting discharge from it could enter the peritoneal cavity; it was thus spoken of as the “*extra-peritoneal*” management of the stump. The proceeding was as follows: It began and proceeded until the child was extracted just like an ordinary (“conservative”) Cæsarean section. Then, without disturbing the placenta, an elastic ligature of rubber tube or a wire loop was passed over the fundus, down behind, and drawn tightly round the upper part of the cervix, so as to cut off its circulation, taking care not to include any part of the bladder or rectum. About an inch above this constricting ligature the uterus was amputated. Then two stout needles, several inches long (like ordinary knitting needles) were passed crosswise through the stump to keep it from drawing back into the abdominal cavity. These needles, resting upon the skin outside, acted as a sort of crucial *button* to keep the stump outside the *button-hole* of the abdominal incision, which was further secured by suturing the circumference of the stump all around into the lower end of the abdominal wound. The remainder of the abdominal incision was then closed in the ordinary way. In ten or twelve days everything outside of the constricting ligature sloughs off and comes away, leaving a small depressed wound to heal by granulation. The operation can be done quickly, even in less time than it takes to do the suturing of an ordinary Cæsarean section, and is comparatively easy for inexperienced operators, but there is always some danger of infection through the sloughing stump, and of subsequent hernia. The convalescence is also protracted.

For these and other reasons the operation has been practically abandoned, or it might rather be said, has given place to the modern method ("intra-peritoneal" method) of treating the stump, now to be described.

The Modern Porro Operation (Cœlio-hysterectomy) Intra-peritoneal Management of the Stump.—Having extracted the child through the uterine incision, as in an ordinary Cæsarean section, and leaving the placenta undisturbed, the remaining successive steps of the operation are as follows: 1. Ligate the the infundibulo-pelvic ligaments (through which run the ovarian arteries) in two places, and cut between, or instead of the second ligature near the uterus, a clamp may be used. 2. Ligate the round ligaments and their contained arteries in the same manner. 3. The broad ligaments are clamped and severed with scissors, on each side. 4. Make a transverse incision through the peritoneum in front, just above the junction of the bladder and uterus; and a similar incision through the peritoneum of the posterior uterine wall, at the same level. Then with the finger or some blunt instrument, strip down the peritoneum to form anterior and posterior flaps, near the lateral junctions of which the uterine arteries must now be found, isolated, ligated, and severed, taking special care to avoid the ureters. 5. The uterus has thus been severed from all its surrounding connections except its junction with the cervix, which is now amputated, and the body of the uterus is removed. In doing this amputation some operators cut straight through transversely; others try to leave a cone-shaped hollow in the cervical stump; and others make a V-shaped incision, leaving a transverse trough-like excavation with anterior and posterior edges. Again some operators burn out the mucous lining of the cervical stump with a cautery; others do not. 6. The edges of the stump are brought together by sutures, and after the anterior and posterior peritoneal flaps are stitched together over it, it is dropped into the pelvic cavity. The openings in the broad ligaments are then closed by running catgut sutures. The pelvic cavity is cleansed by sterile sponging or by flushing with sterile water, and the abdominal wound closed without drainage.

TOTAL HYSTERECTOMY.

When it is desired to take out the whole uterus, cervix and all, the operation is the same as just described for supravaginal amputation, except that when the uterine arteries have been tied, instead of amputating the cervix, the vaginal vault is incised all around it, and the entire uterus removed. After this the opening in the vagina is closed by catgut sutures, and the broad ligament openings and abdominal incision are sutured, just as in the supravaginal amputation cases.

In the three hysterectomy operations above described, the ovaries and tubes are usually removed with the uterus; but one or both ovaries (provided they be not diseased) may be allowed to remain when it is desired to shield the woman (she being young) from the emotional decadence of a premature menopause. In this case the ovarian artery should be ligated *between* the uterus and ovary, not *outside* the ovary through the infundibulo-pelvic ligament, as in our description of the operation previously given.

Removal of the uterus of course prevents any future pregnancy, but when it is desired to do this in a case of *conservative* Caesarean section, the best plan is to excise a portion of each Fallopian tube (where it passes through the cornua of the uterus) by a wedge-shaped incision, and close the wound by sutures, the remainder of the tubes and the ovaries being left in.

After-treatment.—The patient should remain on her back two or three days, the abdominal wall being well supported with a binder, and the vulva dressed antiseptically as in ordinary labor cases. To avoid *vomiting* (which is sometimes a troublesome symptom) *no food* should be taken for twelve hours or even twenty-four, and then at first only liquids, milk, beef-tea, etc., in teaspoonful or tablespoonful quantities as the stomach will tolerate, and repeated at intervals of an hour. Small pieces of ice may be swallowed, which contribute also to relieve thirst. If vomiting persist, support the patient with nutrient enemata and stop all mouth-feeding. The bowels having been well emptied before the operation, may remain undisturbed forty-eight hours, when, if not acting spontaneously, a soap and water enema may be given, or a

glycerine suppository. Should tympanites occur, a teaspoonful of turpentine may be added to the enema. The bladder must be emptied by sterilized catheter every eight hours, if required. If the uterus were packed with gauze during the operation, the tampon must be removed after twenty-four hours, and a second one put in, if desirable, on account of bleeding. The sutures in the abdominal wound should remain ten days. The child should be put to the breast and the woman have the same treatment as after an ordinary labor. Owing to shock or exhaustion, the appearance of the milk may be delayed several days, when the child should be artificially fed; it may still take the breast every six hours, and thus, even after a week, the secretion of milk may become established.

If all go well the patient may sit up in bed after two weeks, and sit up in a chair after three.

Fritsch's Transverse Fundal Incision.—In this method of doing a Cæsarean section, instead of making a longitudinal incision in the median line of the anterior wall of the uterus, the incision goes transversely across the top of the fundus, from one Fallopian tube to the other, or from one round ligament to the other. The advantages claimed for this proceeding are: 1. In consequence of the abdominal wound being higher, there is less danger of subsequent hernia through the line of the abdominal incision. 2. Diminished hemorrhage from the uterine incision and a more firm and rapid shrinking of the uterine wound. 3. After retraction of the emptied uterus, the uterine wall at the fundus is *thicker* than it is lower down, and therefore admits of *more firm closure* by sutures; and, after suturing, massage of the uterus—should this be required to promote contraction—can be more fearlessly employed than when the incision has been made in the anterior wall.

A modification of Fritsch's method has been recently practised by making the fundal incision *longitudinal* instead of transverse. The incision, six or seven inches in length from beginning to end, commences on the posterior aspect of the fundus and extends along the median line over the top and a little way down the anterior surface.

All these methods, under favorable circumstances have given good results. Experience has not yet demonstrated which is

the best. Of one thing, however, we may be sure, viz., in no instance should the uterine incision be so low as to cut into the thinned segment of the womb below the retraction ring of Bandl. (See Chapter XXVII.) This thinned segment cannot be so firmly secured by sutures as the thicker parts of the uterine wall higher up. With regard to hemorrhage, there is no more danger from the longitudinal incision, provided it be made *exactly* in the sagittal line, than there is from the central transverse cut.

VAGINAL CÆSAREAN SECTION.

This operation was devised not for *pelvic* deformities, but to remove obstruction at the os and cervix uteri in cases where immediate delivery was more or less imperative. It is really rapid enlargement of the uterine orifice by extensive incisions instead of by the common slower process of artificial dilatation. Hence it has been done in some cases of eclampsia and antepartum hemorrhage; also when the woman was in *articulo mortis* or dangerously near it from organic disease of the heart, lungs, or other organs, and in cancer of the cervix or cervical stenosis from other causes.

The Operation.—By means of a proper speculum and volsellum forceps, the cervix is brought into view. Transverse incisions are then made through the anterior and posterior fornices of the vagina into the cervix. The bladder is stripped off at its junction with the uterus and pushed up out of the way. Vertical incisions are then made through the median line of the anterior and posterior cervical walls, extending up into the lower uterine segment immediately above the cervix, taking care not to wound the peritoneal coat of the uterus. Through the opening thus rapidly made, the child is delivered by version or by forceps; and after delivery of the secundines the incisions are closed by sutures. In cancer cases the operator goes on to remove the whole uterus by vaginal hysterectomy according to the method of gynecologists.

The operation has a small field, requires special skill, and its merits have not yet been definitely settled.

**CÆLIO-ELYTROTOMY (LAPARO-ELYTROTOMY,
GASTRO-ELYTROTOMY).**

This operation is only of historic interest. It is never done now. Its object was to deliver the child through an abdominal incision without cutting either the peritoneum or the uterus. At first sight this seems impossible, but it is not so. An incision was made just above and in line with Poupart's ligament, down to the peritoneum; then with the finger-ends the peritoneum was carefully peeled off from its connections with the transversalis and iliac fasciæ, until the top of the vagina was reached, and opened on the side. The fundus uteri was then pushed over to the opposite side so as to bring the os uteri into the vaginal opening thus made, and through this last the child was delivered by forceps or version. The unwounded peritoneum was then laid back in place, the abdominal incision closed by sutures, and the vaginal wound left to take care of itself. Details are unnecessary; the proceeding is now quite obsolete.

CHAPTER XXI.

MUTILATING OPERATIONS UPON THE CHILD. EMBRY- ULCIA, CRANIOTOMY; EMBRYOTOMY, ETC.

THE object of these operations is to reduce the size of the child or to divide it in pieces, so that delivery—otherwise impracticable—may be accomplished. Operating upon the *head* is called “craniotomy”; upon the *body* “embryotomy.” Since the term “embryotomy” literally means cutting the embryo, a more correct terminology, suggested by Webster in his recent work, would seem to be *cranial* embryotomy: operating upon the *cranium*; and *corporeal* embryotomy: operating upon the *body*.

Indications.—Conditions requiring mutilation are chiefly malproportion between the size of the child and pelvis, or other mechanical obstacles to delivery such as impacted shoulder presentation (arrested “spontaneous evolution”); arrest of mechanism after posterior rotation of chin in face cases; very rarely, arrest of mechanism after posterior rotation of occiput in head cases; locked twins, etc.

With modern improvements in the Cæsarean section and consequent reduction of danger and mortality attending this operation, mutilating procedures upon the child are happily becoming less frequent than formerly. It is now generally admitted by most obstetricians that no craniotomy should be done in a flattened pelvis the conjugate diameter of which is less than 2 inches (assuming of course the child to be of usual size at full term), and if beside being contracted in the antero-posterior direction, there should also be reduction in the transverse diameter or “general contraction,” then the true conjugate should be $2\frac{1}{2}$ or $2\frac{3}{4}$ inches in order to justify craniotomy. If smaller than these measurements the dangers *to the mother* would be greater than a well-timed Cæsarean section.

When the child is dead and delay in delivery endangers

the mother's life, craniotomy may be done, when the conjugate measures as much as $3\frac{1}{4}$ or even $3\frac{1}{2}$ inches.

When the child is *alive*, and sacrificing it is necessary to save the mother's life, the choice between craniotomy and abdominal section becomes a serious and difficult responsibility. As a rule, most obstetricians accord superior value to the mother's life. In some cases the necessity of a mutilating operation upon the child, as well as abdominal section upon the mother, may be obviated by symphysectomy, as already explained. Much will depend upon the *condition* of mother and child, and the chances of their survival after an abdominal operation, which will again depend upon the surgical skill of the operator and his assistants, and the favorable or unfavorable surroundings of the patient. Again, while the child may not be actually dead, it may be moribund, or so nearly this as to leave little or no hope of its survival after birth. To wait for such a child to die *in utero* before doing a craniotomy, when the mother is in no condition to bear a Cæsarean section, and when, too, the delay may greatly reduce the chances of her own survival, would seem to be unfair to the woman. After the chances and conditions have been fully explained to the patient or her relatives, it would seem but just that they should have a voice in deciding what course to pursue.

When, however, the conditions are *decidedly favorable* for an abdominal section, but this is positively refused by the patient and her friends, the obstetrician must decide, by the dictates of his own conscience, whether to withdraw from the case or do an ill-advised craniotomy. Every man must be governed by his own code of ethics in such emergencies.

CRANIOTOMY. CRANIAL EMBRYOTOMY.

Operation.—The several steps of the operation are: 1. Perforation. 2. Excerebration. 3. Cephalotripsy. 4. Extraction (delivery) of the head, by several different methods.

The patient is placed upon her back on a table of convenient height or crosswise on the bed with her hips near the edge of it. Every aseptic precaution is to be rigidly followed. Anæsthesia while not absolutely necessary to prevent pain, is desirable to shield the woman from the horror

of the proceeding. The first step is *perforation* of the skull. For this purpose perforators ("pierce-crane") have been devised, most of them modifications of Smellie's scissors. (See Figs. 203, 204, 205.)

The instrument consists, in brief, of a scissors with long handles and short blades, the terminal inch of the latter forming a triangle whose apex is the point, and at the base of which is an elevated margin, or projecting shoulder-stops, to

FIG. 203.



FIG. 204.



FIG. 205.

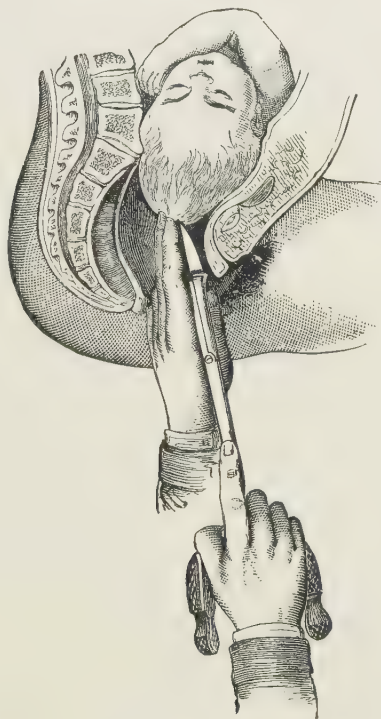


Various forms of perforators.

prevent a too deep penetration. Unlike ordinary scissors, the *outside* border only of the blade is sharp. Carefully guarded and guided by the fingers while entering the vagina (see Fig. 206), the point of the blade is made to penetrate the skull, as nearly as possible at right angles to its surface, to prevent glancing off, until further penetration is arrested by the shoulder-stops. The handles are then manipulated so as to open the blades, the outer edges of the latter thus making an incision in the cranium. After withdrawing the reclosed blade-points from the skull—not from the vagina—the instrument is twisted one-fourth of a circle and again applied as before, so as to

make a crucial incision. It is then pushed more deeply into the cranial cavity and turned about in all directions to break up the brain and its membranes, care being taken, if the child be alive, to kill it at once, by breaking up the medulla oblongata. The points to be preferred for penetration are, in

FIG. 206.



Perforation of the skull.

head presentations, the parietal bone ; in face cases, the frontal bone, orbits, or roof of the mouth ; and in retained head following breech presentations, the base of the occiput, behind the ear, or, if the chin can be pulled down, the roof of the mouth, as in face cases.

When perforating a head that is *movable* at the brim, it should be held steady by the hands of an assistant making external pressure over the abdomen; or the head may be held in place by grasping the scalp near the point to be punctured with a volsellum forceps; or, if practicable, the child may be turned and perforation done on the after-coming head. The operation is easier when the os and cervix uteri are fully dilated, but may be done when dilatation is incomplete, this process being afterward expedited by artificial means.

Beside the scissors, perforators have been constructed on the principle of the trephine. (See Figs. 207 and 208.) A round hole is cut in the cranium, through which the brain may come out, but the scissors are best when it is desired to break up the bones afterward; or the more modern perforator of Tarnier may be used, especially when the head is movable above the pelvic brim, and the scissors are liable to slip off from it. (See Fig. 209.)

Contraction of the uterus, together with resistance of the pelvic walls, after perforation, may cause the brain to ooze out and sufficiently reduce the size of the head to admit of its passage through the pelvis; generally, however, further artificial aid is necessary.

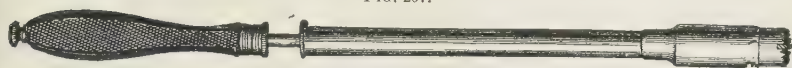
Excerebration (Decerebration).—This is the next step after perforation. It means removal of the brain. This is done by a scoop or spoon passed in through the opening, or a strong stream of sterilized water, or, preferably, a warm 1 to 5000 bichloride solution may be injected with an ordinary Davidson's syringe, and the cerebral mass washed out.

When collapse of the head after these measures is still not sufficient for delivery, we proceed to extract it artificially. The several instruments used for this purpose are ordinary obstetric forceps, the cranioclast, the cephalotribe, the basiotribe, the crotchet, the blunt-hook, and, when the comminuted head requires to be extracted bit by bit, several forms of craniotomy forceps.

The *obstetric forceps* may be used after perforation when there is only moderate resistance to be overcome. In bad cases it is apt to slip, nor does it exert sufficient compression to flatten the skull, and hence is seldom advisable.

The *cranioclast* (Figs. 210 and 211) is unquestionably the best instrument for extracting the skull after perforation. It

FIG. 207.



Martin's trephine.

FIG. 208.



Perforation with Martin's trephine.

consists of a strong solid pair of forceps, with small duckbill-shaped blades, serrated on their apposing surfaces. One blade goes inside the skull, the other outside. They are introduced separately, and lock like forceps. When applied, the inside blade which is smaller than the other and has no fenestra, apposes its convex serrated surface against the concavity of the cranium, while the outside one—larger and having a fenestra against which the other may press—rests its concave serrated surface upon the convex exterior of the skull. When the handles are brought together after locking, the blades grasp the skull firmly, never slip, and occupy hardly any space, since one is inside the emptied cranium and the other imbedded in the soft tissues of the scalp. Laceration of the maternal soft parts is avoided, and should the piece of skull grasped by the instrument break off, it is easy to take a fresh hold by changing the position of the blades. To prevent this

FIG. 209.



Tarnier's perforator.

breaking off, the inside blade may be passed in far enough to touch the base of the skull, while the outer one is applied over the face or lower part of the occiput, thus a firm hold is made on the solid part of the skull near the base, which last is also compressed by turning the screw in the handles of the instrument, and the perforated skull in its entirety is extracted.

Cephalotripsy.—Cephalotripsy consists in crushing the skull with the cephalotribe, an instrument composed of two thick, narrow, solid blades, which are applied singly (like forceps), and after being locked are made to approach each other by means of a screw running transversely through the handles, so that powerful compression is made upon the skull and its bones crushed; or, without crushing, the instrument may simply be used for compression and traction after perforation. (See Fig. 212, page 430.)

The field for the use of this instrument as an extractor is limited. As a rule, it cannot be employed without inflicting

serious injury to the mother when the conjugate diameter measures less than $2\frac{3}{4}$ inches.



Cranioclast.



Braun's cranioclast.

It may be used to compress the skull before it becomes fixed at the brim, and as the instrument here seizes the head obliquely, the consequent bulging of the cranium in the opposite direction takes place in the other oblique diameter, where there is usually more space.

If employed below the brim, the instrument is applied to the transverse diameter, and here compression causes bulging of the head in the antero-posterior direction—just where there is usually less room than anywhere else. Hence, after compression, the head should be rotated into an oblique diameter before traction is attempted.

FIG. 212.



Cephalotribe.

The cephalotribe is sometimes useful in extracting the after-coming head where pelvic contraction is not great.

Piecemeal Craniotomy.—With the proper selection of cases and possession of proper instruments, the field for this repulsive operation has become so limited that some of our modern text-books omit any description of it. Since, however, *under opposite circumstances* the operation will doubtless become an unwelcome necessity, the method of doing it may now be described.

When the pelvis is too small to admit the extraction of the perforated skull in its entirety, the cranioclast or the craniotomy forceps (Figs. 213 to 216) may be used to break off pieces of bone and deliver in fragments. When the whole vault of the cranium has been brought away, bit by bit, the larger fenestrated blade of the cranioclast may be placed in the mouth or under the chin, and the smaller blade inside the base of the frontal bones; the intervening tissues are then compressed by turning the screw in the handles of the instrument, and the remains of the head turned round so as to bring the flattened base of the skull into the transverse diameter of the pelvis. The thickness of tissues between the chin and orbital plates thus grasped is about two inches, and can therefore be drawn through a flattened pelvis the antero-posterior diameter of which slightly exceeds that measurement.

Again, when the cranial vault has been removed by the cranioclast, etc., extraction of the remaining base of the skull, which is too solid to be broken up, may be facilitated by inserting a blunt hook in the orbit, or getting a firm hold on the forehead with craniotomy forceps, and then, by making downward and backward traction, *bringing down the face*. The symphysis of the lower jaw is next divided, and the two halves of the bone pushed aside or removed, when the remaining portion of the face, from the alveolar border of the upper jaw to the root of the nose—only measuring $1\frac{1}{2}$ inches—may be made to enter the pelvis, and the base of the skull extracted.

In taking away the skull piecemeal, smaller instruments of various shapes and sizes—the craniotomy forceps (Figs. 213 to 216)—may be employed.

These differ from the cranioclast in being smaller, and in having their blades permanently joined at the lock, like ordinary tooth forceps. The inner surfaces of the blades are serrated; some are straight, others bent at right angles

(Figs. 215 and 216). They are used to grasp, twist off, and extract pieces of bone, the point of *one* blade going *into* the skull, that of the *other outside* of it, but *under the scalp*, this last having been previously loosened from its attachment to the bones.

FIG. 213.



FIG. 214.



Craniotomy forceps.

In all these operations the greatest care is necessary to avoid lacerating the soft parts while withdrawing sharp bony fragments. The vaginal wall must be pushed aside by the fingers or, better, a large cylindrical or a Sims' speculum used, and the operation conducted under the guidance of sight instead of touch.

The *crotchet* (Figs. 217 and 218) is a steel rod, the end of which, flattened into a sharp, triangular point, is bent round, at an acute angle, to form a hook. It is passed into the

cranium through the foramen magnum or through a perforation made in some solid part of the base of the skull, and its point made to penetrate the bone from within outward, so as

FIG. 215.



Straight craniotomy forceps.

to get a hold by which traction can be made. A finger-end is placed outside, opposite the point of the hook, to prevent

FIG. 216.



Curved craniotomy forceps.

laceration in case the instrument slip or tear out. The "guard-crochet" has a second solid blade (attached to the other by a

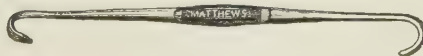
FIG. 217.



Crochet.

"lock"), the end of which takes the place of the finger in fitting over the hook to prevent injury. However constructed,

FIG. 218.



Crochet.

the crochet is a formidable contrivance, and since fearful laceration will often occur, despite all "guards" and care, is now seldom used.

Basiotripsy. The Basiotribe and Basilyst.—While the base of the skull is too solid to be broken up with the instruments thus far mentioned, others have been devised especially for this purpose, notably the “basilyst” of Simpson and Tarnier’s “basiotribe.” The operation is called “basiotripsy.”

Simpson’s instrument (see Fig. 219) consists of a rod whose distal end terminates in a conical screw; both the rod and

FIG. 219.



Simpson's basilyst.

the screw are split longitudinally, and so arranged that the two halves may be forcibly separated by a device at the handle. The screw is passed into the skull—through the opening previously made by perforation—until it come in contact with the base, which, by a boring motion, it is made to penetrate until the instrument is well fixed, when, by pressing

FIG. 220.



Simpson's basilyst, when applied.

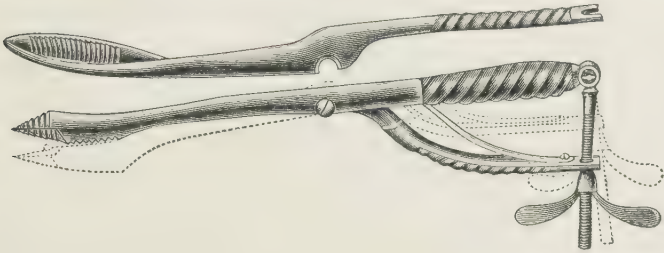
the two parts of the handle together, the two halves of the screw separate (see Fig. 220) and break up the bone.

More recently Simpson has improved his original device by adding a third blade which is introduced over the outside of the face or occiput, and when properly adjusted thus converts the instrument into a cranioclast, as shown in Figs. 221 and 222.

Tarnier's basiotribe (Fig. 223) is composed of three pieces, viz.: two strong blades and a central shaft. The central shaft, at its distal end, terminates in a hollow cone of four bars, the apex of which is a screw. In using the instrument, the central bar, by itself, is bored into the dome of the skull

(perforation), then pushed on through the brain, until the screw come in contact with the base and penetrate it. The two blades (one long and one short) are then introduced, one on each side of the head, as shown in Fig. 224, and crushing of the skull produced by turning the compression screw

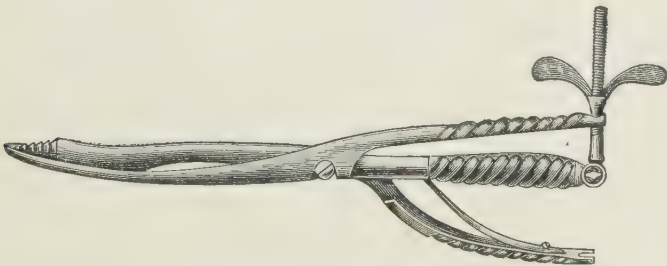
FIG. 221.



Simpson's improved basilyst, disarticulated. (From WILLIAMS.)

passing through the handles. The instrument is really a cephalotribe, with the addition of a third blade or shaft for breaking up the base of the skull. The shaft is provided

FIG. 222.



Simpson's improved basilyst, articulated. (From WILLIAMS.)

with a button pivot, by which it is locked securely to the other blade when applied. After using the device successfully the skull will be crushed and reduced in size, as shown in Fig. 225 (page 437), the outline sketch representing the shape of the compressed cranium.

Generally speaking, a pelvis sufficiently large to allow extraction of the head by craniotomy will permit the body to pass without mutilation. It may be necessary, however, to

FIG. 223.



Tarnier's basiotribe.

pull on the neck until a blunt-hook can be passed into the axilla, by which the shoulders—first one, then the other—may be drawn out.

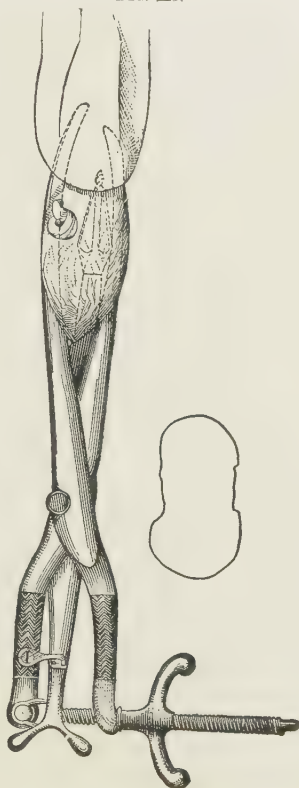
Exceptionally it may be necessary to operate on the body of the child ; corporeal embryotomy.

FIG. 224.



Application of Tarnier's basiotribe.

FIG. 225.



Basiotripsy accomplished.

CORPOREAL EMBRYOTOMY.

This embraces several operations, viz. : Decapitation, evisceration, spondylotomy, and cleidotomy.

Decapitation.—Separating the head from the body is required in impacted shoulder presentations (arrested “spontaneous evolution”) when the child is jammed tightly in the

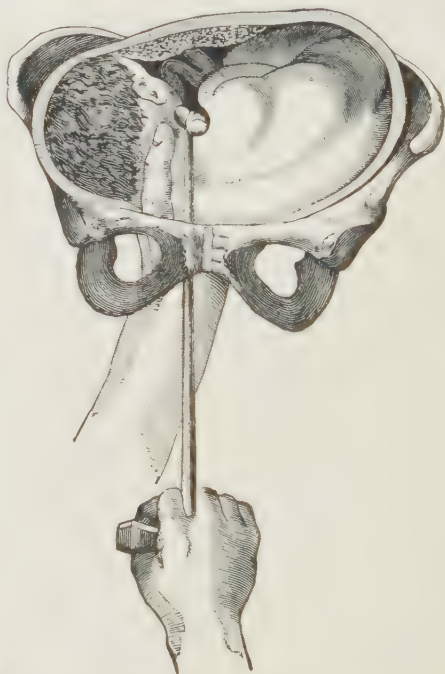
pelvis and cannot be moved up or down; or again, in cases, without impaction, but where the lower segment of the uterus is so thin below the ring of Bandl that version would be sure to produce uterine rupture. It may also be done on the after-coming head of a child whose delivery is prevented by "locked twins" (*q. v.*).

FIG. 226.



Carl Braun's decapitation hook.

FIG. 227.



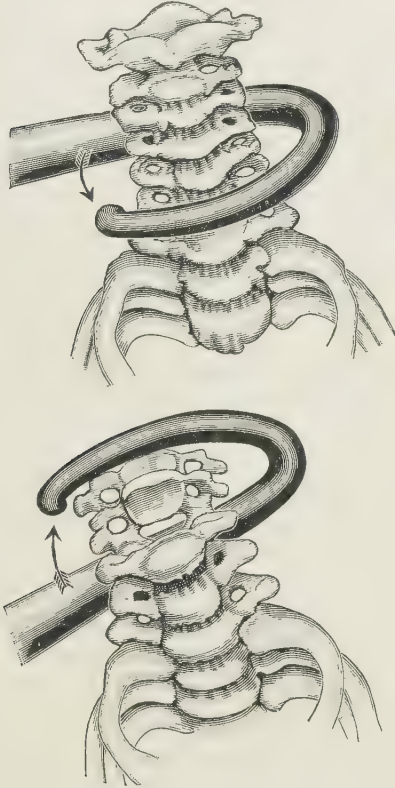
Decapitation by Braun's hook.

Operation.—Get down an arm for traction, pass a blunt-hook around the neck, and while it is held as low down as possible, nibble through the vertebrae and soft parts with a blunt-pointed pair of scissors. Cut everything, so that the

hook or finger may be passed through the incision to ascertain that the head and body are *completely* separated.

The best device for decapitation is Braun's blunt-hook (Fig. 226) made for the special purpose of disarticulating the vertebræ.

FIG. 228.



Disarticulation of cervical vertebræ by the decapitation hook. The arrows indicate the to-and-fro movement of the hook made by the rotary motion of the handle, through 180 degrees or thereabouts.

The bladder and rectum being, of course, empty, the hook is guided over the neck by the index-finger, which also

guards the point of the instrument from injuring the mother; then with strong traction on the handle and a brisk *to-and-fro, rotary motion* the cervical vertebrae are disarticulated, perhaps with a perceptible snap. By repeating the movements the remaining tissues of the neck may be completely severed, or this severance may be hastened by blunt scissors while the hook is making steady traction. When the arm is down, the operation may be facilitated by strong traction upon it made by a fillet in the hands of an assistant.

Other contrivances consist of chains, wires, and strings passed around the neck and through a long, double canula, to protect the vagina, while, by a sawing to-and-fro movement, the neck is severed.

After decapitation, the head is pushed up out of the way and the body delivered first, by traction on the arm, evisceration, etc. The remaining head is then extracted by forceps or, if required, by craniotomy. In attempting the latter operation upon a decapitated head, extra care is necessary to prevent slipping of the perforator. An assistant steadies the uterus by firm abdominal pressure to keep the head from revolving while the instrument is being used; or he may steady it from below by long volsellum forceps hooked into the scalp *per vaginam*.

Evisceration (Exvisceration, Exenteration).—Evisceration means opening the thoracic and abdominal cavities (one or both) and taking out their viscera.

It may, though very rarely, be necessary in extracting the body after craniotomy, or when there is some abnormal enlargement, or monstrosity, on the part of the child. It is resorted to more frequently in impacted transverse presentation, arrested "spontaneous evolution," etc.

Operation.—The thorax is penetrated near the axilla by curved scissors or the pierce-crane, and the thoracic organs broken up and removed, either by instruments or, if practicable, by the fingers. Through the same opening the diaphragm may be perforated and the abdominal viscera removed. The same care is necessary as in craniotomy to avoid lacerating the vagina with splinters of bone.

When evisceration is performed subsequent to craniotomy, the body may be afterward drawn out by a blunt-hook in the axilla, as above directed.

In impacted transverse presentations the eviscerated body may be delivered in one of three ways, viz. : (1) By traction on the arm and shoulder ; (2) by passing a blunt-hook to the groin and pulling down the breech ; (3) by grasping the feet and delivering by podalic version. Which mode is to be selected must be left to the judgment of the obstetrician, much depending upon the position of the child, its size, and the shape and dimensions of the pelvis.

Spondylotomy (Division of the Spinal Column).—This may be necessary in those rare transverse cases where the *back* presents and delivery by more benign methods is excluded. While an assistant holds the child firmly against the pelvic brim by abdominal pressure, the spine is divided by strong scissors, or by bone forceps, *per vaginam*. The lower segment of the spinal column is then drawn down by strong forceps, or by a cranioclast, and scissors are again used to completely divide the child's body transversely, the two halves being then delivered separately (lower half first) by traction with the cranioclast or some other suitable forceps.

Cleidotomy (Division of the Clavicles).—This has recently been done in impaction of the shoulders from their excessive width, or from a contracted pelvis, in both head and breech presentations. Normally the bisacromial *circumference* measures about $13\frac{1}{2}$ inches (34 cm.), which may be reduced one or two inches by division of both clavicles, the ends of the severed bones over-riding each other, as in fractures.

A long pair of scissors, guided by the fingers, is introduced *closed*, along the *anterior* surface of the child, *per vaginam*, until the ridge of the clavicle is reached, when the instrument is opened just wide enough to grasp and divide the bone. It may be done on one or both sides. The divided bones at once over-ride each other.

If done on a *living* child (which has been suggested) the division should be made near the scapular end of the bone, or between that end and the middle, to avoid the subclavian vessels, which lie toward the sternal end.

CHAPTER XXII.

PELVIC DEFORMITIES.

A GENERAL study of pelvic deformity is necessary, in order that we may learn to ascertain—at least approximately—the *degree* and *kind* of malformation existing in a given case. A knowledge of the *degree* of deformity indicates whether delivery by the natural passages be or be not practicable, and determines the mode of assistance by operative measures. A knowledge of the *kind* of malformation, derived chiefly from examination of specimens in museums, indicates what diameters are most likely to be altered in length, and what parts of the pelvis—brim, cavity, or outlet—are chiefly affected, thus determining necessary modifications in the mechanism of labor, and indicating the methods of treatment.

Numerous attempts have been made to classify the various kinds of deformity, grouping them according to their etiology and pathology; their modes of origin, etc., and while this is eminently desirable for scientific purposes, it belongs to the pathologist rather than to the obstetrician. The characters of the different types of deformity—of their varieties and sub-varieties—may be so mixed in a given case, that no one can say to which group it properly belongs. The rachitic pelvis may be combined with the deformity of osteomalacia, the so-called pseudo-osteomalacic rachitic pelvis. Again kyphosis and rachitis may coexist, producing the *kypho-rachitic pelvis*; and to this may sometimes be added scoliosis producing the *kypho-scolio-rachitic pelvis*. There are many subvarieties of this sort, but if one ask what is the obstetrical management of labor in these different varieties of pelvic contraction, the same answer applies to all, viz.: it depends upon the length of the pelvic diameters and the size of the child's head, in each given case.

It may lessen the embarrassment of the student and young obstetrical practitioner, and give them some encouragement

in considering this somewhat difficult subject, to reflect that many of the varieties of pelvic deformity described in the books are *very rare*, and will seldom be met with in practice. Let it be noted also that at least *two forms* of pelvic contraction are of comparatively common occurrence, so common that they constitute the principal basis from which rules for obstetric practice have been formulated. These two forms are: (1) The "*flattened pelvis*" and (2) the "*generally contracted pelvis*." And to these may be added a less common *third* variety, viz., (3) a combination of the two, that is to say, a "*flat*" pelvis with "*general contraction*."

Now let it be understood that by a "*flattened*" pelvis we mean one with *antero-posterior* flattening; the sacrum and pubes are too near together, the conjugate diameter is short.

The "*generally contracted pelvis*" explains itself; *all* its diameters are short, its *shape* may be normal, but its *size* is too small.

Finally, such a *small* pelvis may also be "*flattened*" antero-posteriorly, producing the combination (3) above stated.

The great majority of cases met with in practice come under one or other of these three kinds of pelvic contraction. It is from experience with *these* cases that rules for practice have been agreed upon. In the rarer forms of pelvic narrowing, no definite rules can be stated. Every case must be treated by itself, on general principles.

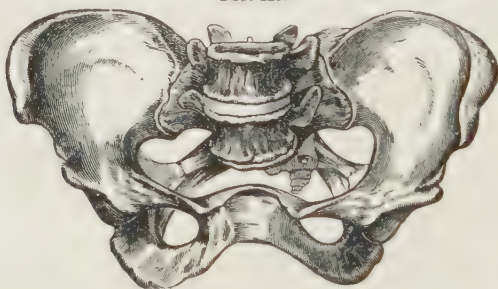
The Flattened Pelvis: Rachitic and Non-Rachitic.—The *typical* rachitic pelvis is the most common and most important of all deformities. The pelvic brim is shortened antero-posteriorly, the sacrum sinking *down* between the ilia, and having its promontory tilted *forward* toward the pubes, thus producing the "*flattened pelvis*,"—*i. e.*, it is flattened antero-posteriorly, the posterior and anterior pelvic walls approach each other too closely.

With the forward tilting of the sacral promontory (as if the whole sacrum had rotated a little on a transverse axis) there necessarily occurs backward projection of those segments of the sacrum immediately below the promontory; in fact, this part of the bone projects so far backward as to become almost horizontal. (See Fig. 229.) At or about the junction of the fourth and fifth sacral vertebrae, this backward projection abruptly ends with a sharp bend *forward* (also seen in

Fig. 229). This bending forward of the lower end of the sacrum (and coccyx) is partly due to its being held back by the sacro-sciatic ligaments and other attachments, and partly to the sitting or semi-recumbent posture so frequently assumed by rachitic children who are too feeble to walk. The concavity of the sacrum is lessened from side to side, and may even become flat or convex from forward projection of the bodies of the upper sacral vertebræ.

Most of all must it be noted that the normal relation between the length of the interspinous and intercrestal external measurements ($9\frac{1}{2}$ and $10\frac{1}{2}$ inches respectively) is *lost, i. e.*, instead of the interspinous being an inch shorter than the intercrestal, the two are nearly or quite alike, or the interspinous

FIG. 229.

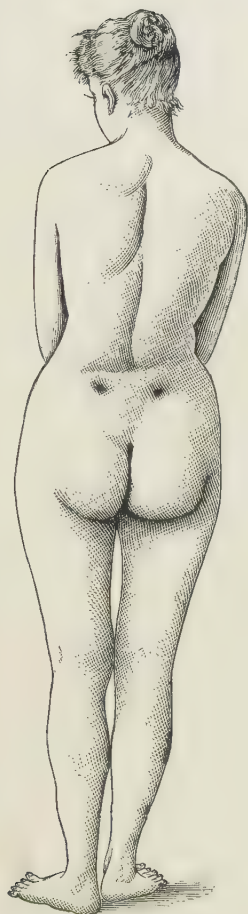


Rachitic pelvis with backward depression of symphysis pubis.

even measures *more* than the intercrestal. This is due to the wings and crests of the ilia, which, instead of maintaining their normal degree of vertical elevation, become spread out laterally, hence the anterior superior spinous processes become farther apart. The rami of the pubes become flattened, the pubic arch widened, and the ischia diverge from each other. The total result is a *shallow pelvis* with *contracted brim* and *expanded outlet*.

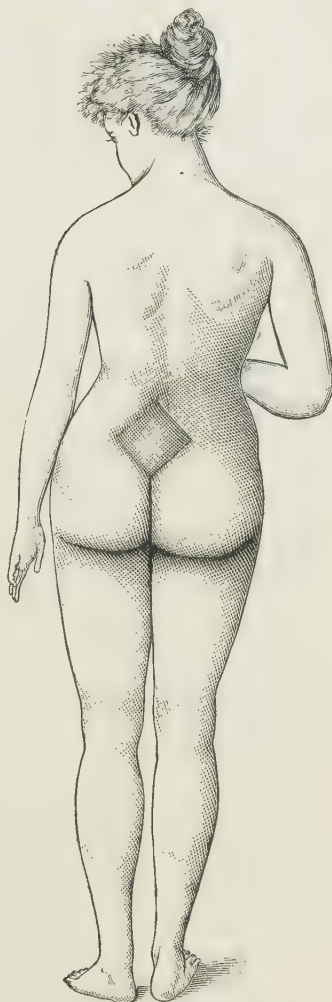
There is often a relative lengthening of the transverse diameter of the brim, which might be compensative, were it not for the fact that the pelves of rickety subjects are usually undersized *ab initio*, hence the lengthened transverse diameter seldom exceeds the normal measurement.

FIG. 230.



Woman with flat pelvis. (From DAVIS, after STRATZ.)

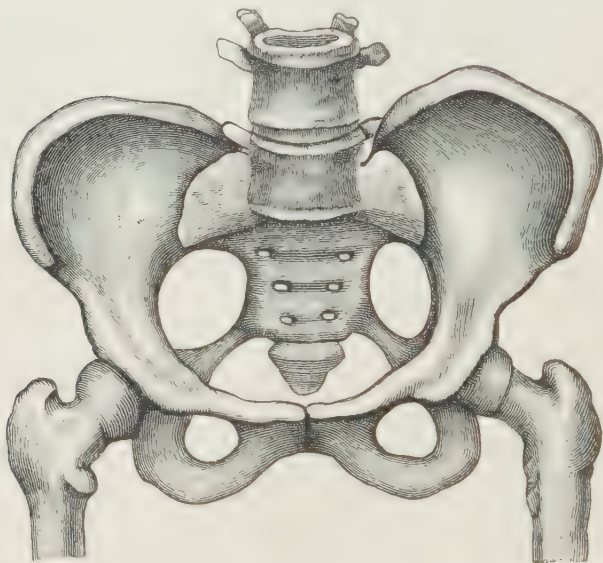
FIG. 231.



Woman with normal pelvis. Lozenge of Michaelis well formed. (From DAVIS, after STRATZ.)

The whole contour of the pelvic brim usually becomes more elliptical, or kidney-shaped, varying with the degree of anterior projection of the sacral promontory, as shown in Fig. 229, in which there has also occurred a depression of the pubes from traction by the recti muscles.

FIG. 232.



Flat non-rachitic pelvis. (From JEWETT, after KLEINWACHTER.)

On inspection, a rachitic woman, standing erect, shows posteriorly, a transverse depression (almost the beginning of a fissure) across the back, produced by the backward or horizontal projection of the sacrum, while from the same cause, the normal vertical internatal fissure is so far obliterated as to render the anus visible.

Such are the *usual*, and most pronounced characteristics of the typical *rachitic flattened* pelvis. More rarely all sorts of variations occur; thus, conjointly with the foregoing alterations there may be *lateral curvature* of the spine, hence the

scolio-rachitic pelvis in which one acetabulum is pressed in, producing irregular and oblique deformity, owing to the curved spine causing the patient to walk with the weight of the body more on one acetabulum than the other. Again, if the rickety child, with its softened pelvic bones, be able to run about, the weight of its body falling equally upon *both* acetabula, then *both* sides of the pelvis will be pressed in, producing a deformity resembling that of osteomalacia, hence called "*pseudo-malacosteon*" or "*pseudo-malacia*." So, possibly, we may have a rickety *infantile* pelvis, or a rachitic "*generally contracted*" pelvis, and many other complications. But these are *unusual*; the common rachitic pelvis, with conjugate flattening, as first above described, is the one from which we get most trouble in obstetric practice. The *degree* of obstruction has no limit; in slight cases it is moderate; in bad ones so great as to make Cæsarean section a necessity.

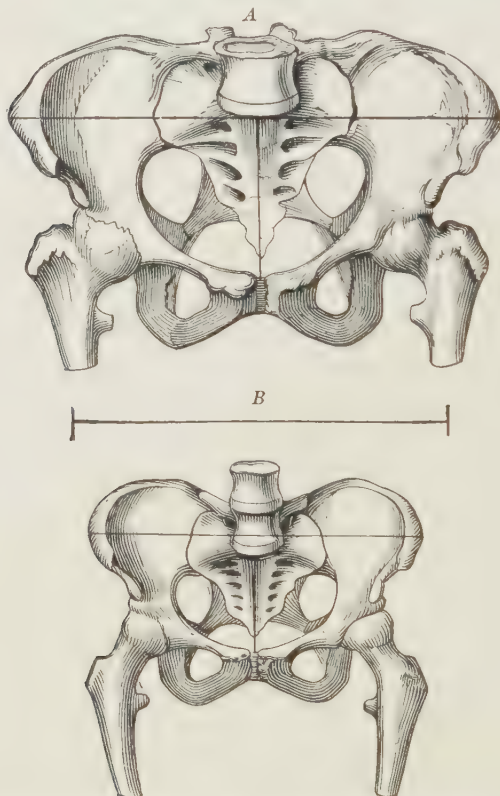
Beside the *rachitic* flattened pelvis there occurs quite frequently, a flat pelvis *without* rickets; the *non-rachitic flat pelvis*. In some countries of Europe it is said to be more common than the rachitic variety. Fortunately it seldom or never produces very *great* obstruction, the conjugate diameter is scarcely ever less than three inches and in most cases it is three and a half or three and three-quarters. (See Fig. 232.)

The obstruction is produced, as in rickets, by sinking down of the sacrum between the ilia, but, *unlike* rickets, the sacral promontory does *not* project forward by rotation of the sacrum on its transverse axis, hence there is no tilting backward of the sacrum below the promontory. Nor is there any expansion at the outlet. The sacrum (which is usually smaller than usual) simply sinks *downward*, hence what little degree of obstruction occurs, exists in all parts of the pelvis; superior and inferior straits as well as in the cavity. The lateral walls of the pelvis do *not* flare apart laterally, hence the *normal relation* between the interspinous and intercrestal external measurements is preserved; *i. e.*, the intercrestal remains longer than the interspinous.

The "Generally Contracted" Pelvis.—The most common form of "*generally contracted*" pelvis is the so-called "*pelvis equabiliter justo-minor*," in which the *shape* of the pelvis is normal, but the *size* is small; hence the measurements of *all* of its diameters are *proportionately* shortened. It was observed

in 37 per cent. of the contracted pelves reported by Müller, and in 28 per cent. of Gömmer's cases. Williams, of Baltimore, found it in one-third of the contracted pelves occurring in white women, and in two-thirds of those in black women. Observe

FIG. 233.



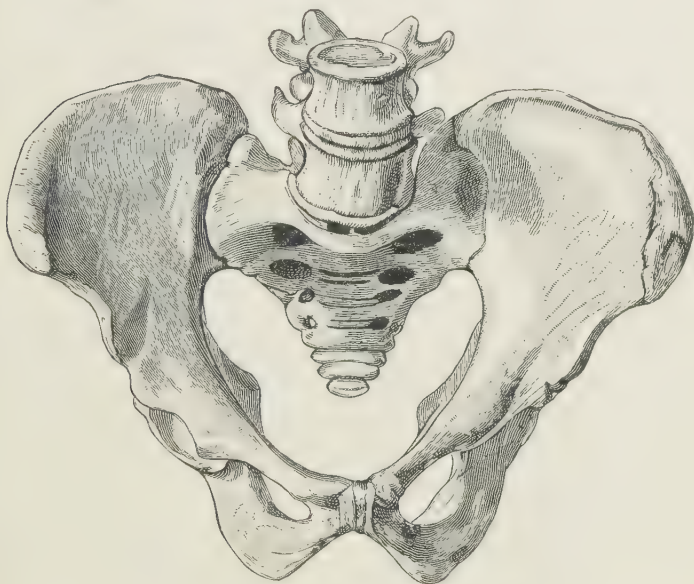
A. Justo-major pelvis. B. Normal inter-crestal diameter. C. Justo-minor pelvis.

that in this justo-minor pelvis, the contraction is *symmetrical*; it is a congenital variation, existing *ab initio*, and is not accompanied by any disease or softening of the bones; in fact, the pelvis is quite normal, *except in size*. While it is more

likely to occur in small women, it is also found in larger and apparently well-made individuals.

Beside the *justo-minor* pelvis, "*general contraction*" may also occur with the *flat* pelvis of *rachitis*. That is to say, while the shortening of the true conjugate, common to the rachitic flattened pelvis, is very pronounced, there is also *some* contraction of *all* the other diameters, but not a *proportionate*

FIG. 234.



The juvenile (infantile) pelvis. (From JEWETT, after AHLFELD.)

contraction as in *justo-minor* cases. The pelvis is *decidedly* flat, while the other diameters are only *moderately* contracted.

Very *rarely* a "*generally contracted*" pelvis is met with, due to *rachitis*, in which there *is* a more or less *proportionate* contraction of *all* diameters. There is certainly nothing impossible in such an unusual combination. Williams, who has met with some cases in the negro race, designates them as "*generally equally contracted rachitic pelvises.*"

The Symmetrically Enlarged Pelvis (Pelvis Equabiliter Justo-major).—Exactly opposite to the justo-*minor* pelvis is the justo-*major* one. It is a congenital condition. The shape is natural; size in all directions increased. It is observed, not only in giantesses, but also in women of usual size. Labor is apt to be unnaturally rapid, with consequent liability to uterine inertia, post-partum hemorrhage, perineal lacerations, and all the other results of "Precipitate Labor" (see pages 550 and 551).

A representation of the justo-major and justo-minor pelvises, as compared with the normal size, is shown in Fig. 233.

FIG. 235.



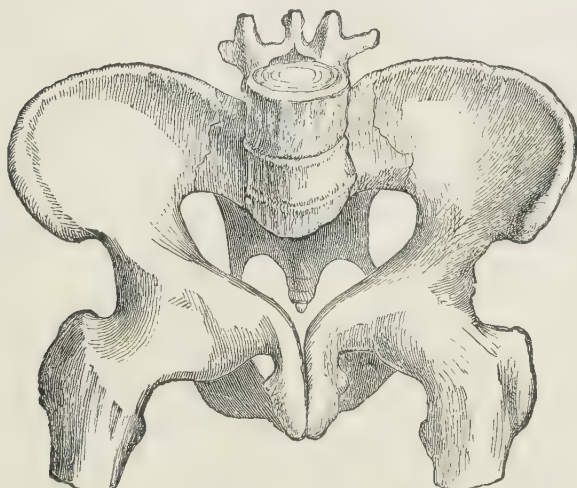
Masculine, or funnel-shaped pelvis. (From JEWETT, after WINCKEL.)

The Juvenile Pelvis.—Shape resembles the pelvis of infancy and childhood. (See Fig. 234.) It is an arrest of development. Transverse measurements relatively shorter than the conjugate, owing to narrowness of sacrum. Sides of pelvis unnaturally straight, pubic arch narrow, and ischia too near together. Labor difficult or impossible, *pro re nata*. In precocious mothers time may remedy the deformity.

The Masculine Pelvis.—Sometimes called "funnel-shaped." It is deep and narrow, resembling that of a male, the narrowness increasing from above downward; hence obstruction to labor most marked toward the outlet. The pelvic bones are thick and solid, a condition thought to be produced by laborious muscular work only suitable for men. (See Fig. 235.)

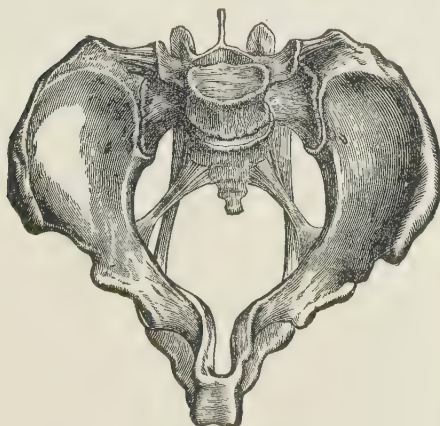
The Malacosteon Pelvis (see Figs. 236 and 237).—Results from osteomalacia, á uniform softening of the bones occurring

FIG. 236.



Osteomalacic pelvis, with beak-like shape of pubes.

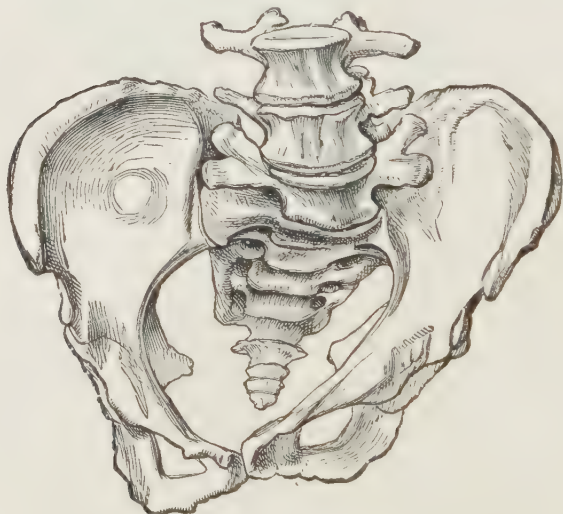
FIG. 237.



Osteomalacic pelvis.

in *adult* life. It may come on in women who have previously borne children without difficulty. Its progress being gradual, the patient is able to *walk* about, hence pressure of thigh bones in acetabula pushes in the *sides* of the pelvis, shortening the *transverse* diameter. Anterior border of pelvic brim has a spout-shaped or beaked appearance. Exceptionally, and in very bad cases, the oblique and conjugate diameters may be also contracted. Osteomalacia is about four hundred times less frequent than rickets. Craniotomy or Caesarean section may be required for delivery. Sometimes the softened bones

FIG. 238.

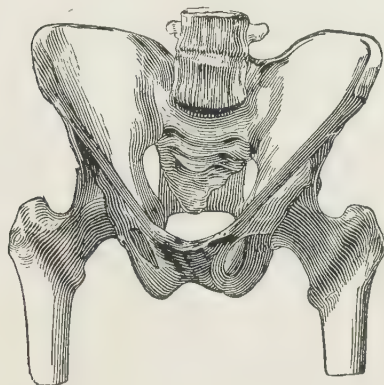


Oblique deformity of Naegele; disease on *left* side. (BARNES.)

yield and admit the passage of the child by other methods. In doing an abdominal section in these cases the *ovaries* should always be removed. Castration arrests the disease of the pelvic bones. The uterus may or may not be removed. (See pages 416, 418.)

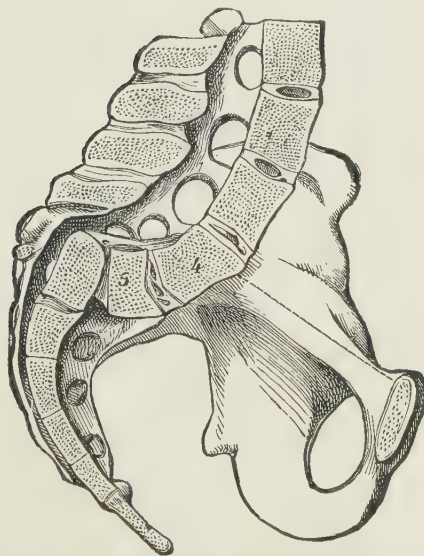
The Oblique Deformity of Naegele (see Fig 238).—The sacro iliac synchondrosis of *one* side is ankylosed, the corresponding wing of the sacrum atrophied, or imperfectly devel-

FIG. 239.



The Roberts pelvis.

FIG. 240.



Spondylolisthetic pelvis. 4. Fourth lumbar vertebra. 5. Fifth lumbar vertebra.
(KILIAN.)

oped, so that the acetabulum of *this* side approaches the healthy sacro-iliac synchondrosis of the other, shortening the oblique diameter between these two points. The other oblique diameter, starting from the *diseased* sacro-iliac synchondrosis, is lengthened, owing to the symphysis pubis and acetabulum of the healthy side being forced out of place toward the sound side of the median line. This variety of deformity is comparatively rare.

FIG. 241.



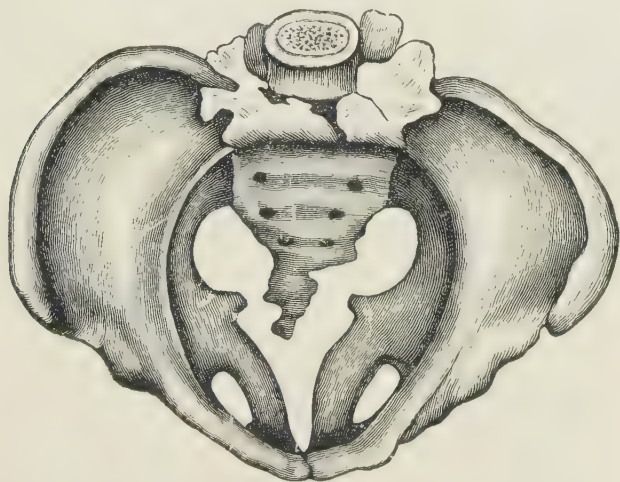
The kyphotie pelvis.

The "Roberts Pelvis" (see Fig. 239).—A double oblique deformity. *Both* sacro-iliac synchondroses anchylosed, and *both* wings of the sacrum absent or undeveloped. The brim is oblong; pelvic sides more or less parallel with each other; ischia pressed toward each other, and sides of the pubic arch nearly parallel. Transverse diameter *universally* shortened

at brim, cavity, and outlet. Obstruction very great, requiring Cesarean section. It is really the oblique deformity of Naegele occurring on both sides, and is extremely rare.

The Spondylolisthetic Pelvis (see Fig. 240).—Due to forward and downward dislocation of the lumbar end of the spinal column, from its proper place of support on the base of the sacrum. It produces marked contraction of conjugate diameter of the brim, and, owing to sacral promontory being forced somewhat backward, the apex of sacrum may be tilted forward, thus lessening conjugate diameter of outlet. Degree of obstruction very great, sometimes requiring last resorts is operating.

FIG. 242.

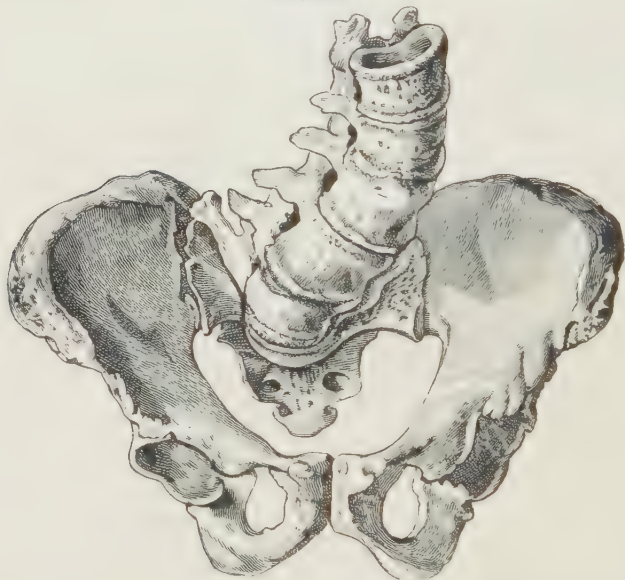


Kyphotic pelvis showing contracted outlet. (From JEWETT, after KLEIN-WACHTER.)

The Kyphotic Pelvis (Fig. 241).—*Kyphosis*.—Antero-posterior curvature of the spine, with the “hump” projecting *backward* (especially when below the dorsal region) causes the weight of the body above the bend to be transmitted to the sacrum in such an abnormal direction as to force the base and promontory of the bone backward and downward, and displace its apex (and coccyx) forward. The sacrum is also

lengthened vertically, and narrowed from side to side. Hence the innominate bones approach each other below; the ischial spines and ischial tuberosities are brought nearer together, and *all* the diameters of the pelvis below the brim are short, especially the transverse ones. The result is a contracted pelvic cavity, especially emphasized at the outlet (see Fig. 242).

FIG. 243.



The kyphoscolio-rachitic pelvis. (From JEWETT, after AHLFELD.)

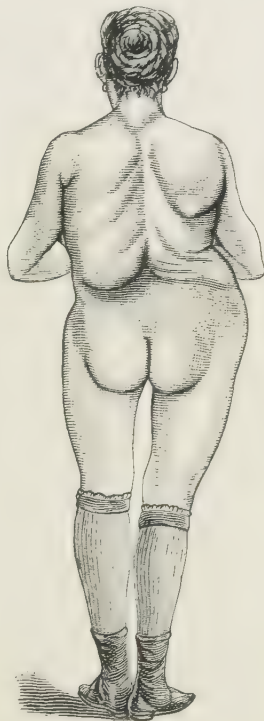
Since the contraction increases from above downward the pelvis becomes more or less funnel-shaped. The conjugate diameter of the brim is lengthened, owing to recession of the sacral promontory. In about 30 per cent. of kyphotic pelvis there is also some "*general contraction*." There are many "humpbacked" women who escape pelvic deformity. According to Klein, kyphotic pelvis occurs once in 6,016 labors. A still rarer form of kyphotic pelvis is the so-called *pelvis obtecta*, in which that part of the spine projecting forward above the hump encroaches upon the pelvic brim.

The Scoliotic Pelvis.—*Scoliosis.*—Lateral curvature of the spine, when low down, may produce a slight (but not serious) *oblique* contraction of the pelvis. The innominate bone toward which the deflected lumbar spine is bent, receives more than its share of the body-weight, hence pressure by

FIG. 244.



FIG. 245.



Side and back views of woman with kyphoscolio-rachitic pelvis. (From JEWETT, after MARTIN and FASSBENDER.)

the head of the femur on this side forces this half of the pelvis upward, inward, and backward, pushing the acetabulum toward the sacral promontory and the pubic symphysis toward the opposite side. In simple scoliosis labor may not be much

obstructed; but, unfortunately, most cases of scoliotic pelvis are combined with rachitis and its deformities, when the obstruction may be extreme. Again, scoliosis and rachitis may be combined with kyphosis, producing the "*kyphoscolio-rachitic pelvis*" (Fig. 243, page 456).

Lordosis.—Lordosis is antero-posterior spinal curvature with the convexity in *front*, does not interfere with labor. It is extremely rare as a primary condition, but occurs somewhat more frequently as a compensative sequence of kyphosis. Hirst (*Text-book of Obstetrics*, page 499) depicts a primary case which he ascribed to paralysis of the spinal muscles.

FIG. 246.



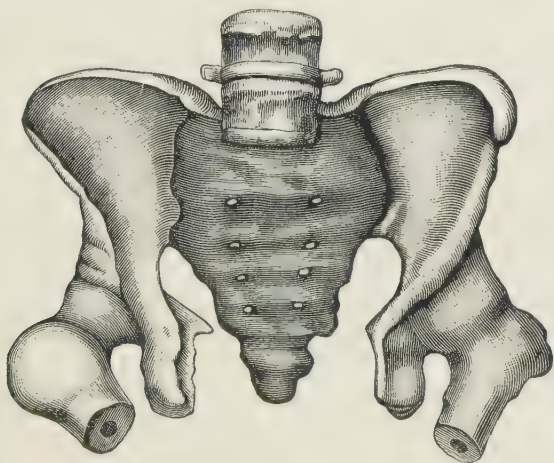
Obliquely contracted pelvis from coxalgia: coxitis on right side, deformity on left. (Mütter Museum, College of Physicians, Philadelphia.)

Deformity from Hip Disease (see Fig. 246).—Coxitis (inflammation of the hip-joint), occurring in early life, causes the patient to rest the weight of the body on the healthy hip, while the lame one is not used. Consequently the healthy side of the pelvis is gradually pushed over toward the diseased side, producing an oblique deformity resembling the oblique

pelvis of Naegele. The earlier in life the disease begins, the greater the deformity. In Fig. 246 the *right* side is the diseased one; the *left* half of the pelvis, having supported the weight of the body upon the left acetabulum, is pushed over toward the right side. Thus that side of the pelvis having the *normal* hip-joint is deformed; the other one *not* so. The deformity is not *usually* sufficient to seriously obstruct labor, but *may* be so exceptionally.

A similar oblique contraction may be produced by congenital dislocation of one femur, by the loss of one leg in early life, or by any condition which leads to a persistent overuse of one lower limb.

FIG. 247.



The split pelvis. (After KLEINWACHTER.)

The Split Pelvis (Fig. 247).—A very rare condition of faulty development, in which the pubic bones are widely separated. It produces "*Precipitate Labor*."

Deformity from Exostosis, etc. (see Fig. 248).—Bony and osteosarcomatous tumors growing from pelvic bones—most often from front of sacrum—project into pelvic cavity and produce obstruction. Bony projections also occur from callus resulting from fracture of the bones. The ischial spines are sometimes too long, and encroach upon the pelvic canal.

Ordinary Symptoms of Pelvic Deformity without Reference to Any Special Case.—Previous history of difficult labors, and of the diseases or accidents by which pelvic deformity is produced; shortness of stature, spinal curvature, pendulous belly, lameness, increased obliquity, and mobility of the uterus. *Moderate* pelvic contraction can occur without these symptoms. Since a contracted brim will not admit the head, the latter is movable above the brim, when it ought to have become fixed by descent. On vaginal examination the sacral promontory is more easily reached; the finger can pass

FIG. 248.

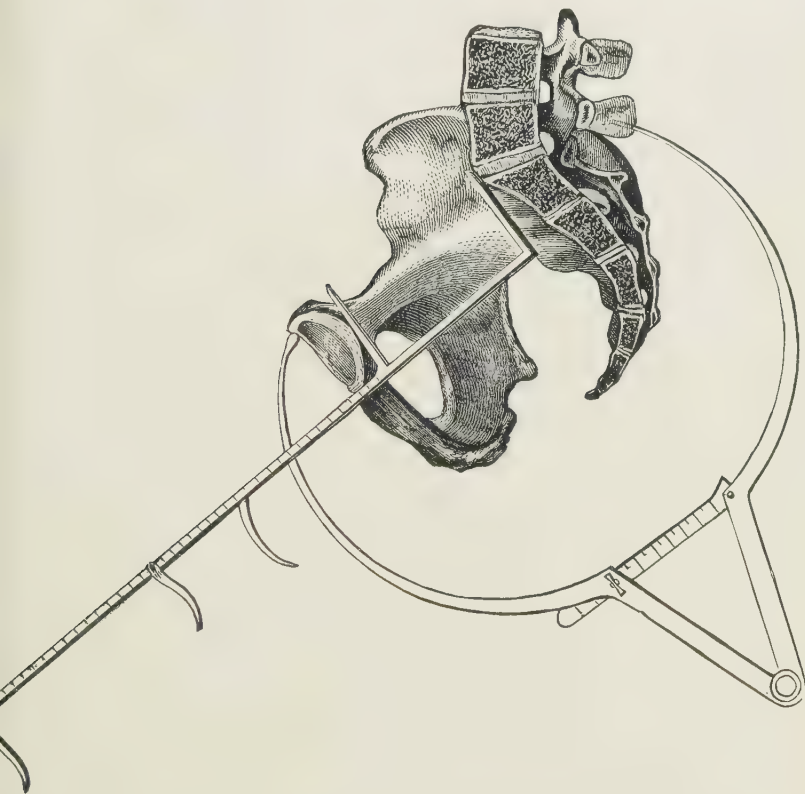


Bony tumor of sacrum.

more easily between the ring of the os uteri and bag of waters; the latter protrudes during a pain, perhaps in a finger-glove form. The presenting part is high up when brim is contracted. Intense pains produce no proportionate descent of presenting part, the latter becomes "*arrested*" when there is partial descent; or later on "*impacted*" (when it cannot be moved up or down). Unusually large caput succedaneum; its gradual swelling may be mistaken for progress in descent. Liability to malpresentations and to presentations of funis.

Additional Symptoms in Special Cases.—In *rickets*: “bow-legs,” curved spine, and other deformities of the skeleton, with history of rachitis in early life.

FIG. 249.



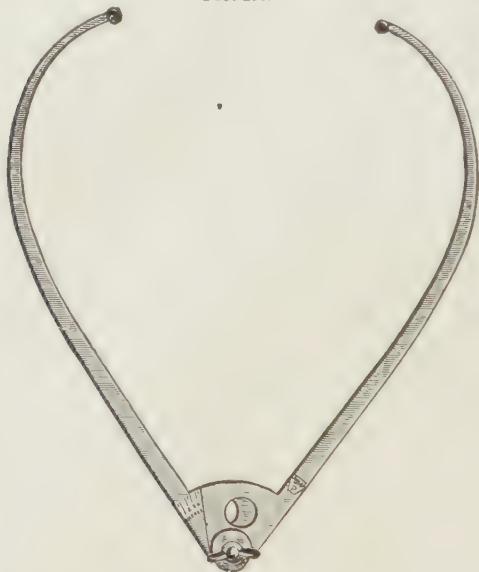
Baudelocque's calipers. This figure also shows Coutouly's pelvimeter applied.

In *osteomalacia* (malacosteon): probable history of previous labor without difficulty, the disease beginning soon after a delivery. Symptoms of osteomalacia are pains in bones of pelvis and lower limbs; bones tender on pressure, especially over symphysis pubis. They are also pliable, yielding to

manual pressure during labor. "A history of rheumatoid pains and difficult locomotion, requiring rest in bed during pregnancy, associated with a decrease in height, is almost pathognomonic of osteomalacia" (Williams).

Old-standing cases of *hip disease* present previous history of coxalgia. The diagnosis in the above cases must be confirmed, and in the other varieties made out almost entirely by measuring the pelvis (pelvimetry).

FIG. 250.



Collyer's pelvimeter.

Pelvimetry.—Pelvimetry may be accomplished both by internal and external measurements. The best *pelvimeter* (pelvis measurer) is the *hand*.

To measure conjugate diameter of the brim, pass index finger under pubic arch and rest its point against sacral promontory.¹ (See Fig. 251, page 463.) (It is not easy to *touch* the promontory in a *normal* pelvis.) With a finger-nail of the

¹ Take care not to mistake the (sometimes prominent) junction of first and second sacral vertebræ for the *real* promontory.

other hand make a mark on the examining finger where it touches the pubic arch. Withdraw the finger and measure (with a rule) from the mark to its tip. From this measurement deduct half an inch, and the remaining length gives the conjugate diameter of the brim. The half-inch is subtracted

FIG. 251.



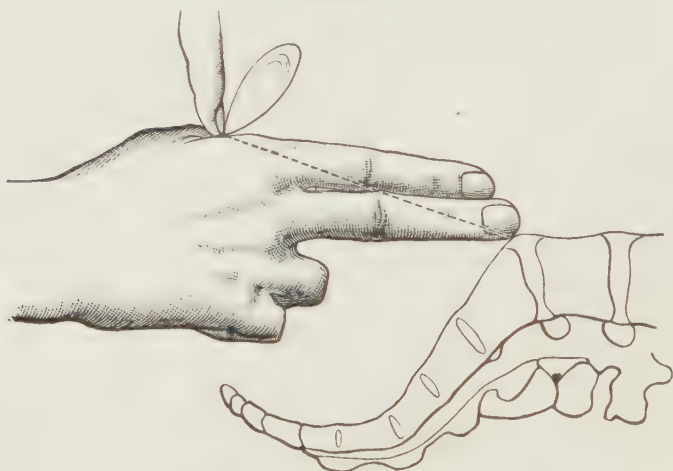
Pelvimetry with the finger.

because the length as measured from the promontory to the *under* surface of the pubic symphysis (the *diagonal* conjugate, see Fig. 4, page 29) is half an inch longer than from the promontory to the *upper* surface of the pubic joint, the latter being the *brim* measurement it is desired to ascertain. During this

examination the woman should lie on her back with the hips elevated.

This measurement may be facilitated by using two fingers instead of one. The tip of the middle finger touches the promontory, while the index finger rests against the pubic symphysis. A finger-nail of the other hand marks the point on the index where it touches the pubic joint, and afterward a rule measures the distance across the two fingers as shown by the dotted line in Fig. 252.

FIG. 252.



Measuring the diagonal conjugate with two fingers. (JEWETT.)

Another method: Patient lies on her left side, near the edge of the bed. Etherize, if necessary, to prevent pain. Introduce entire hand into vagina and dispose it flatwise with the little finger toward symphysis pubis and the index-finger against sacral promontory. Learn how many fingers can thus be *simultaneously* introduced between the two points. The breadth of four fingers, in a hand of average size, is about two and three-quarters inches. The fingers introduced may be afterward measured by a rule. (See Fig. 253, page 465.)

Many pelvimeters have been made for internal use, notably those of Greenhalgh (Fig. 254), Lumley Earle (Fig. 255), and

the more modern devices of Hirst, Faraboeuf, and others. It is hard to say which is the best. Few obstetricians possess these instruments; most are content with the results obtained by the hand for internal pelvimetry, and a good pair of calipers for external use.

External Pelvimetry.—Some modification of Baudelocque's instrument is generally used. It consists of a pair of circular calipers (Fig. 249, page 461), a scale near the hinge indicating the space between the open ends when applied. An inexpensive calipers is that of Collyer, Fig. 250, page 462.

FIG. 253.



Measuring conjugate diameter with whole hand. (After DAVIS.)

In using the calipers let the thumb and index finger of each hand grasp the little knob on each arm of the instrument, so that the terminal ends of finger, thumb, and knob, *all touch the skin together*; then with a number of little lateral to-and-fro motions, the finger and thumb readily *feel* the points upon which it is desired to place the knobs for measurement. Having done this, hold the knobs in position, while inspecting the scale near the hinge of the calipers, to ascertain the distance between them. To measure conjugate diameter of brim,

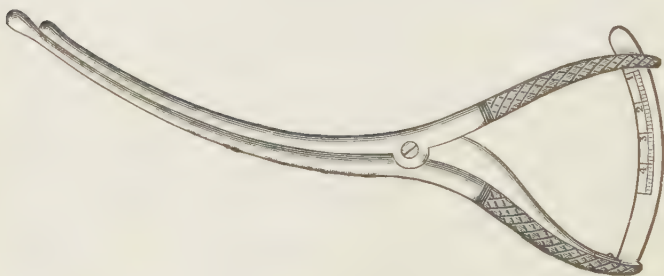
the woman lying on her side, place one point of the instrument upon the *upper* edge of pubic symphysis, and the other

FIG. 254.



Greenhalgh's pelvimeter.

FIG. 255.



Lumley Earle's pelvimeter.

opposite sacral promontory, *i. e.*, over the depression just below spinous process of last lumbar vertebra. (See Fig. 249, page

461.) Normally this should measure $7\frac{1}{2}$ inches. Deducting $3\frac{1}{2}$ for thickness of bones and soft parts, leaves 4 inches—the normal length of the brim's conjugate diameter. The degree of reduction in this measurement, allowing for individual variation from obesity, etc., will give *approximately*, the amount of pelvic contraction, but a limited reliance only can be placed upon this method without other corroborative evidence of deformity.

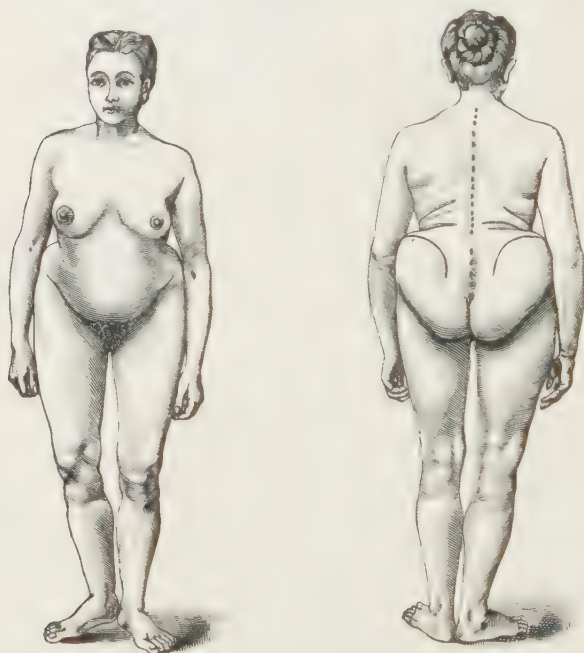
Two other external measurements are important, viz. : (1) Between the two anterior superior spinous processes of the ilia (normally $9\frac{1}{2}$ inches); and (2) between the most laterally projecting points on the two *crests* of the ilia (normally $10\frac{1}{2}$ inches). When both measurements are reduced it indicates a uniformly contracted pelvis. When the inter-crestal measurement is normal, or only a *little* diminished, while the interspinous one is increased, it indicates a pelvis with conjugate contraction of the brim, but otherwise normal. When *both* measurements are *decidedly* diminished, while the interspinous one exceeds the inter-crestal, other diameters are contracted *beside* the conjugate.

The Lozenge of Michaelis.—Just below the spinous process of the last lumbar vertebra a barely visible depression may be observed (on this depressed point the posterior arm of the calipers is applied in measuring the conjugate diameter). A little lower down, on each side, two very distinct dimples may be seen, which indicate the position of the posterior superior spinous processes of the ilia. Lines drawn from the depressed point first mentioned, to the lateral dimples, and then from these dimples to the upper end of the internatal fissure, will enclose a four-sided space, the lozenge of Michaelis. (See Fig. 231, page 445.) *Normally*, the four sides and angles of this space are *about* equal; the transverse diameter, $3\frac{7}{8}$ inches (9.8 cm.) slightly exceeding the vertical one. Any pronounced variation indicates an *abnormal* pelvis.

Diagnosis of the Oblique Deformity of Naegele.—Lameness, from inequality in the height of the hips. If two plumb lines be suspended, one from the centre of the sacrum, the other from the symphysis pubis (the patient standing erect), the pubic one will deviate toward the healthy side. Measuring from the spinous process of the last lumbar vertebra to

the anterior and posterior spinous processes of the ilia, will show a reduction of half an inch or more on the diseased side. Anatomical features of the deformity, already described, to be further made out by vaginal examination.

FIG. 256.



Front and back view of woman with spondylolisthetic pelvis. (From JEWETT, after WINCKEL.)

Diagnosis of the Kyphotic Pelvis.—Mensuration reveals marked narrowing of space between tuberosities of the ischia, between ischial spinous processes, and between sides of pubic arch. Space between anterior superior spinous processes of ilia, decidedly increased. Absence of sacral promontory and other anatomical characters revealed by vaginal touch. Humpback visible by inspection.

Diagnosis of Spondylolisthetic Pelvis.—Figure peculiar; (see Fig. 256), thorax normal; abdomen short and sunken between crests of ilia, the latter widely separated. Aortic pulsations felt through posterior vaginal wall. History of violent pains in sacrum at puberty (?). Vaginal examination reveals dislocation at sacro-lumbar articulation.

Diagnosis of "Roberts' Pelvis."—Owing to narrowness of sacrum, the spaces between the two iliac crests, between the two iliac spines, between the two trochanters, and between the two ischial tuberosities, are all reduced. The two posterior-superior iliac spinous processes, especially, approach each other.

Diagnosis of Masculine Pelvis.—Mensuration demonstrates diminished width between pubic rami and between ischial tuberosities, etc. No obstruction of labor at superior strait; head arrested in pelvic cavity.

Dangers of Pelvic Deformity.—Tedious labor; shock; exhaustion, and inertia of uterus from prolonged contractile efforts. Inflammation, ulceration, and sloughing of maternal soft parts from contusion and prolonged pressure. Child's life jeopardized by prolapsed funis; by continued and exaggerated compression of cranium, especially against sacral promontory. Operative measures for delivery may necessitate destruction of infant.

Modifications in Mechanism of Labor when Conjugate Diameter of Brim Only is Contracted.—Flexion is imperfect. The occipito-frontal diameter of head occupies transverse diameter of pelvic brim. The biparietal diameter is tilted so that one end is lower than the other,¹ hence the *anterior* parietal boss presents near the pubes, while the *posterior* one is tilted backward and *upward* toward posterior shoulder, which carries the sagittal suture toward the sacral promontory. (See Fig. 257.) Thus anterior end of biparietal diameter is permitted to descend before posterior one; there is not space for *both* to enter *simultaneously*. The somewhat wedge-shaped *sides* of head impinging against promontory and pubes, now cause occiput to slip, laterally, toward that ilium to which it points, thus bringing the narrower bitemporal

¹ This lateral tilting of the *head* is sometimes spoken of as the "*obliquity of Naegele*"; it is quite separate from, and has nothing to do with, the oblique deformity of the *pelvis* described by Naegele.

diameter ($3\frac{1}{4}$ inches) to occupy the contracted conjugate in place of the wider biparietal one. As descent thus proceeds, the forehead and larger fontanelle are lower than occiput and small one; but, later, flexion occurs, which brings occiput down on one side of pelvis, while forehead rises up on the other. In this way the brim is passed, when, the chief difficulty being over, occiput rotates to the pubes, and labor is completed in the usual manner.

FIG. 257.



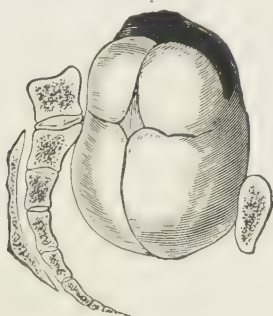
Head passing through inlet in flat pelvis. (After PARVIN.)

Modifications in Mechanism of Labor when Pelvis is Uniformly Contracted.—The head may enter in any pelvic diameter, though usually in the oblique. Flexion is unusually complete, so that occipital pole of occipito-mental diameter points almost vertically down at right angles to plane of superior strait. (See Fig. 258.) The "obliquity of Naegele" is very slight or absent. Both parietal bosses enter at the same time. Small fontanelle found near centre of pelvis. Should transverse narrowing continue toward outlet, the *extreme flexion* continues with liability to impaction and arrest; but if the pelvis widen below the brim, the exaggerated flexion lessens, and the occipital pole of the head leaves its central position, and rotates, in the more favorable cases, toward the pubes, when delivery follows in the usual way.

Modifications in Mechanism of Labor when Pelvis is "Generally Contracted" with Antero-posterior Flattening.— In this case we have the "Naegele obliquity" of flattened pelvis, joined with the exaggerated flexion of justo-minor cases. The occipito-frontal diameter of the head usually occupies the transverse diameter of the pelvis. If delivery be possible, strong flexion causes the occiput to descend first.

Defects in Methods Requiring Rectification.— In pelves with very narrow conjugate and high promontory, especially, but sometimes in others that are less so, the "obliquity of Naegele" is *over-done*. The posterior parietal bone is directed *too* strongly toward posterior shoulder, so that sagittal suture may be even *above* sacral promontory, and the ear

FIG. 258.



Marked flexion of head entering a generally contracted pelvis. (After PARVIN.)

be felt just behind pubic symphysis. In flattened pelves with transverse shortening, the obliquity may be the other way; the *posterior* parietal bone presenting, the sagittal suture being toward or even above the pubes, while an ear is felt near promontory. Again, the proper deficiency of flexion in the early stage of labor in flattened pelves may be overdone, thus leading to brow or face presentation, and in which anterior rotation (respectively) of forehead or chin will be impossible later on.

During breech deliveries, in contracted pelves, the arm may be displaced to the sides of the head, and this last may be unfortunately extended by the chin catching against the

pelvic brim. In marked transverse shortening, extension of the chin in breech cases makes delivery impossible without perforation.

Methods of Assisting Delivery in Pelvic Deformity.—Excluding, for the present, the induction of labor before full term (to be considered in the next chapter) the resources of the obstetrician are forceps, version, symphyseotomy, Cæsarean section, and craniotomy.

In deciding the methods of operating in different sized pelves, it is evident the size and compressibility (capacity for moulding) of the child's head should be determined. Unfortunately this can only be done approximately. Instruments for measuring the unborn head are unsatisfactory; the best we can do is to grasp the brow and occiput of the head with the hands (under anaesthesia) by abdominal palpation, and by steady pressure downward and backward, in line with axis of superior strait, ascertain with what readiness or difficulty, if at all, the head may be made to enter the pelvic brim.

During labor, with a fully dilated os, the entire aseptic hand may enter the vagina, and thus estimate the size of the head in relation to the pelvis. In multiparæ, the hardness and size of the head in previous pregnancies may afford some information; remembering, however, the liability to increased size with successive labors.

Beside the dimensions of the head, a third factor, to be considered in any given case, is the *strength of the labor pains*. Strong pains may accomplish delivery where weak ones would necessitate artificial aid.

Remembering then that in every case of difficult labor from contracted pelvis, the three factors of *power, passage, and passenger* (*i. e.*, pains, pelvis, and child) must be duly considered, let us now return to the methods of operating in different degrees of pelvic narrowing.

Owing to improvements and diminished mortality in the Cæsarean section, modern obstetrics has largely increased the field for this operation and lessened the cases for craniotomy. The determination of operative methods according to pelvic measurements is now in a transitional stage; authorities differ. Hard and fast rules are impracticable, but there are some important points upon which all agree, to be now emphasized, *viz.:*

First.—To admit a given operation “*generally contracted*” pelvis require a conjugate diameter of one-fourth of an inch longer (some say one-half) than would be necessary for the same operation in a simply “*flattened*” pelvis. That is to say, if a “*flat*” pelvis with a conjugate of 3 inches would admit the passage of a given head, a “*generally contracted*” pelvis, to admit the same sized head, would require a conjugate of $3\frac{1}{4}$ (some say $3\frac{1}{2}$) inches, no matter by what operation the delivery were accomplished.

Second.—When the conjugate¹ is 2 inches (5 cm.) or less, Cæsarean section is the only resort, be the child alive or dead. Craniotomy would be more dangerous to the mother than abdominal section. The tendency is to restrict the limit for craniotomy still further. Some consider $2\frac{1}{2}$ or $2\frac{3}{4}$ inches, or $2\frac{1}{2}$ in “*flat*” and $2\frac{1}{2}$ in “*generally contracted*” pelvis, as the limit below which craniotomy should be excluded. Eliminating these small fractions and remembering the impossibility of accurately measuring the head, let us fix on an even 2 inches as the conjugate measurement excluding craniotomy and requiring abdominal section.

Third.—When the conjugate is between 2 and $2\frac{3}{4}$ inches (5 to 7 cm.) in flat pelvis (or one-fourth inch longer in justo-minor cases) the treatment will be craniotomy if the child be dead, and Cæsarean section if it be alive. Symphyseotomy is excluded below $2\frac{3}{4}$. In selecting the Cæsarean operation regard must be had to the *condition* of the woman (whether exhausted or infected) and the condition of the child, as to its being uninjured and likely to survive the proposed operation. But so far as the pelvic measurements are concerned, the operation must be one or the other, either craniotomy or Cæsarean section, according to existing conditions.

Fourth.—When the conjugate is between $2\frac{3}{4}$ and 3 inches, in “*flat*” cases (or one-fourth inch longer in “*generally contracted*” pelvis) the choice of operation is extremely difficult. Forceps, version, symphyseotomy, Cæsarean section, and craniotomy may each be properly resorted to under different conditions to be now stated.² *Forceps* delivery will be extremely difficult; it may or may not succeed. The instrument is therefore

¹ By the “conjugate” as here repeatedly used, we mean of course the “*conjugata vera*” of the brim.

² In this discussion we refer always to full term children of average size, as a matter of course.

used tentatively and with care not to injure or infect the patient, the *axis-traction* forceps *only* being used, in conjunction with the Walcher position (see Fig. 177, page 368) and only after several hours of strong pains have had a chance to reduce the biparietal diameter by *moulding* of the head. Since this diameter normally measures $3\frac{1}{2}$ inches it is evident that some moulding *must* occur to allow its transit through a conjugate of less than 3 inches. But since heads differ in size and compressibility, a tentative use of forceps may be advisable.

Version.—Podalic version will enable the narrow *base* of the skull to enter a contracted brim, which the larger dome of a vertex presentation would not do. (Fig. 259.) More-

FIG. 259.



FIG. 259.—Section of foetal skull showing base narrower than dome. AA. Biparietal diameter. BB. Bitemporal diameter.

FIG. 260.

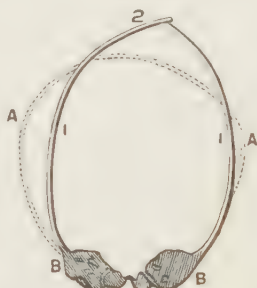


FIG. 260.—Further narrowing of cranium by pressure after turning. AA. Outline of skull *before* version. B 1 2. Outline *after* turning.

over, after turning, the operator may expedite delivery by traction on the body below, and pressure on the head from above, while the resistance of the pelvic walls during traction produces further narrowing of the cranium as shown in Fig. 260. This is the theory, and it is true; but unfortunately, displacement of the arms, delay with the after-coming head, and compression of the cord, produce so great an infant mortality (about 35 per cent.) that the operation is declining in popularity though it has some advantages so far as the mother is concerned.

Symphiseotomy.—The measurements of the conjugate we are now considering are exactly those suitable for this oper-

ation, perhaps in conjunction with forceps or version, as already stated. (See "Symphyseotomy," Chapter XX.). But the whole subject of symphyseotomy is still *sub judice*. Its popularity is "on the wane." If it is to hold any rank of utility in contracted pelves, these are the measurements in which it is justifiable in properly selected cases.

Cæsarean Section.—To avoid the dangers and difficulties of forceps and the infant mortality of version in these cases (conjugate between 3 and $2\frac{3}{4}$), the Cæsarean operation, under *favorable circumstances* would certainly be preferable. These circumstances are a healthy woman, uninfected and without exhaustion; an uninjured child; a competent operator; together with an assistant, instruments, materials, and surroundings necessary for the provision of a rigid aseptic technique. These circumstances *may* be *perfectly* attainable by operating early in a proper hospital. In private practice they may be only partially (or doubtfully) attainable; here the obstetrician must use his judgment as to the *degree* of risk involved by the operation.

In operating on an infected case the Cæsarean operation should be followed by total hysterectomy.

Craniotomy.—This operation may be done to hasten a required speedy delivery, when the child is *dead*; and in cases where the child is dying, or has been injured by forceps, and the mother is infected, craniotomy is still justifiable, unless the woman desire to run the risk of abdominal section for the sake of her infant.

Fifth.—When the conjugate is $3\frac{1}{2}$ to 4 inches in "flat" (or one-fourth inch longer in "generally contracted" pelves) the mode of delivery will usually be by forceps—the axis-traction instrument being used, either with or without the Walcher position. If the head be not overlarge, and the pains are normally strong, with time for moulding, many of these cases will be delivered spontaneously. In case of exhaustion (of woman or womb) assistance with forceps is the rule. When the head has passed the brim, the Walcher position must be discontinued, since it lessens the capacity of the outlet.

Reducing these statements to tabular form it may be said that as a general rule (not to be rigidly followed, however) the methods of operating in the different degrees of pelvic contraction in "*flattened*" pelves (from one-fourth to one-half

an inch being added to the figures to allow the same proceeding in a "*generally contracted*," or justo-minor case, will be as follows:

When conjugate diameter of brim measures :	The mode of delivery at term is :
Between 4 and $3\frac{1}{2}$ inches	By Forceps.
Between $3\frac{1}{2}$ and $2\frac{3}{4}$ inches ¹	{ By Forceps, Version, Symphyseotomy, Cæsarean section, or Craniotomy, <i>pro re nata</i> .
Between $2\frac{3}{4}$ and 2 inches	{ Cæsarean section, if child alive. Craniotomy, if child dead.
At 2 inches or less	{ Cæsarean section always. Craniotomy excluded, (whether child dead or alive.

As before stated, and as a matter of course, selection of the method of delivery must *not* depend *solely* upon the length of the conjugate diameter. Since we cannot during labor measure the pelvis *exactly*, and still less the child's head, the impossibility of mathematical rules for practice is painfully evident.

Furthermore, no two sets of cases are exactly alike, and the experience of no two practitioners exactly similar; hence hardly any two authorities exactly agree with regard to the pelvic measurements determining the kind of operation to be employed. In cases with the *larger* figures above mentioned, the operation called for will be comparatively easy; with the *smaller* measurements, more difficult.

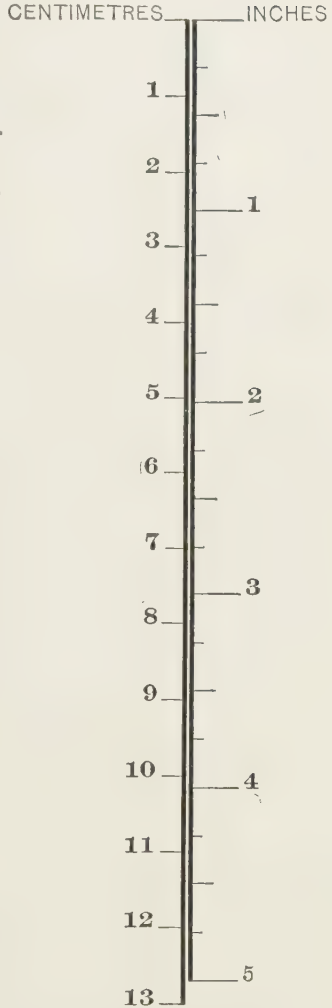
Among the host of other considerations upon which our selection must, in part, depend, may be mentioned: 1. The *kind* of contraction: whether (*a*) simple antero-posterior flattening, or (*b*) general contraction, or (*c*) both of these combined. 2. The *site* of contraction: whether at brim, cavity, or outlet. 3. The estimated size of the head and its degree of ossification. 4. Whether or not it be "*arrested*," or "*impacted*" (and at what point in the pelvis), or have passed through the os uteri. 5. The amount of dilatation of the os, and the state of the membranes. 6. Retraction of uterus

¹ These are also the measurements for the induction of premature labor, to be considered in the next chapter.

above the head with consequent vertical tension of vaginal wall. 7. Is the child dead or alive, and if the latter, will its life be jeopardized or lost by the proposed operation? 8. History of former labors (if any) and results of methods then employed. 9. The *number* of previous deliveries, as indicating present labor-power. 10. Imminent danger or actual occurrence of uterine rupture. 11. General condition of woman as regards her ability to survive the proposed operation. 12. The "presentation" and "position" of the child. 13. The existence of complications, such as hemorrhage, eclampsia, placenta prævia, prolapsed funis, etc. 14. The estimated knowledge, acquired skill, and native dexterity of the operator, together with (what is not often sufficiently considered) the *kind of hand* he happen to possess, whether small, soft, and pliable, or the reverse.

An approximate estimate of the *size* and *consistency* (hard or soft) of the child's head may be obtained by external palpation over the lower abdomen. In this way also may we ascertain whether the widest (biparietal) diameter have or have not entered the brim, and whether it be possible to force the head into the brim by manual pressure from above.

FIG. 261.



Relative scale of inches and centimetres.

As much must depend upon whether the child be alive, we may here note the signs of its death.

Signs of Fatal Death in Utero.—Some of these have already been mentioned in the chapter on "Abortion" (page 193). Additional ones recognizable during labor are cessation of fetal heart-sounds after they have been previously recognized; cessation of quickening, especially when immediately preceded by irregular and tumultuous fetal motions. The discharge of meconium, when the case is *not* a breech presentation, is of some significance. In *head* presentation the scalp is soft and flabby; the cranial bones are loose and movable, and may be felt to grate against or overlap each other more than usual. No *caput succedaneum* is formed during labor since there is no circulation in the scalp to produce it. In *breech* cases the anal sphincter is relaxed and does not contract on the finger. In *face* cases the lips and the tongue are flabby and motionless. In *arm* presentation the *living* limb is warm, perhaps somewhat livid or swollen from pressure above, and it may be made to move; not so the *dead* arm. In *funis* presentation the living cord is warm, firm, turgid, and pulsatory; the dead one cold, flaccid, empty, and pulseless. Some of the above signs, it will be evident, can only occur when the child has been dead some time before labor—the condition of the scalp and cranial bones, for example.

In any doubtful case where the hand enters the uterus, it may feel whether the cord pulsate, and how strongly; or feel the precordial region of the child and thus recognize its heart-beats.

CHAPTER XXIII.

THE INDUCTION OF PREMATURE LABOR.

By the end of the twenty-eighth week of pregnancy the child is sufficiently developed to be capable of extra-uterine life. Delivery between the twenty-eighth week and full term is called "premature labor"; *before* the twenty-eighth week, "abortion."

Cases in which It is Proper to Induce Premature Labor.—

1. In pelvic deformity where there is sufficient space for a seven months' child to be delivered without injury. The object is twofold: (*a*) To save the child's life by obviating the necessity for craniotomy; (*b*) to spare the mother the dangers of craniotomy, Cæsarean section, symphyseotomy, or other operations that might be required if the pregnancy went to full term.
2. In cases where, in previous labors, the head of the child at full term has been prematurely ossified, or unusually large, so that labor has been difficult and dangerous, even though the pelvis were normal. The period of delivery need only be two or three weeks before "term" in these cases.
3. In cases where the children of previous pregnancies have died *in utero* during the later weeks of gestation from disease (fatty, calcareous, or amyloid degeneration, etc.) of the placenta.
4. In conditions where the continuance of pregnancy seriously endangers the mother's life, such as excessive vomiting; albuminuria; uræmic convulsions, or paralysis; chorea; mania; organic disease of the heart, lungs, liver, bloodvessels, etc., threatening fatal disturbance of the respiration, circulation, and other vital functions; irreducible displacements of uterus; placenta prævia with hemorrhage; and in dangerous pressure upon neighboring organs from over-distention of uterus, due to dropsy of amnion, tumors, multiple pregnancy, etc.

Induction of Premature Labor in Pelvic Deformity.—In *flat pelvis* (the more common rachitic deformity) the degree of conjugate contraction in which it is proper to induce premature delivery, when it is designed to save the child's life, is practically limited to between $2\frac{3}{4}$ and $3\frac{1}{2}$ inches.

A child at the end of the seventh lunar month (28th week) may be delivered alive through a conjugate diameter of 24 inches.

One at the end of the eighth lunar month (32d week) through 3 inches—possibly through $2\frac{3}{4}$.

One at the end of the ninth lunar month (36th week) through $3\frac{1}{2}$ inches.

When the measurement is over $3\frac{1}{2}$ inches the labor may be left till full term (40th week).

In *generally contracted pelvis*, when *all* diameters are shortened, the conjugate must measure at least *one-quarter of an inch longer* than the figures given above, in order to allow the same rules of operating to be followed.

Owing to the difficulty of determining *exact* size of the head and pelvis, the more precise rules given in text-books are practically useless. Furthermore, it is not always easy to ascertain with *precision* the duration of pregnancy. The selection of any week intermediate of the periods above noted must be left to the judgment of the obstetrician, and decided by the circumstances of each case. The most usual time for bringing on labor, all things considered, is between the thirty-second and thirty-fourth week. The date for inducing labor may be decided by *Müller's method*: Near the end of the seventh month, weekly examinations are begun. Two fingers in the vagina are made to touch the head below, while a hand over the abdomen grasps it from above. Over *this* hand, the two hands of an assistant are superimposed. So long as prudent pressure by the three hands can push the equator of the head down through the brim, labor may be deferred, but when at any subsequent (weekly) examination the head has grown too large to be thus forced down, labor must be induced at once. Labor pains, with moulding, will still cause descent, though the hands fail to do so.

In any case with a conjugate of $2\frac{3}{4}$ inches, chances of saving the child's life are exceedingly small; but as craniotomy, symphyseotomy, and abdominal section are the only other

means available, the attempt ought to be made, delivery being aided, if necessary, by version, or by small forceps—a diminutive instrument having been constructed for this purpose.

When the conjugate diameter measures *less* than $2\frac{3}{4}$ inches, *abortion* should be induced as soon as possible after the diagnosis of pregnancy is certain. When the conjugate diameter measures $1\frac{1}{2}$ inches, induction of abortion must not be postponed later than the beginning of the twenty-first week ; when $1\frac{1}{4}$, not later than the beginning of the seventeenth week ; and when only one inch, not later than fourteen weeks. If, however, the woman (being childless, or for other reasons) prefer to risk the dangers of a cutting abdominal operation, and there are no special circumstances rendering such a course peculiarly inadvisable, the case may be allowed to go to term, and the child then extracted promptly by section through the abdomen.

Methods of Inducing Labor in Early Pregnancy before the Child is Viable.—Two methods of inducing abortion in common use during the early months are : 1. *Dilatation of the os and cervix uteri.* 2. *Puncture of the amniotic sac.*

1. *Dilatation of Cervix.*—The vagina and vulva, the hands and instruments of the operator having been rendered aseptic, a tupelo or laminaria tent (previously sterilized)¹ is passed well up into the cervix with a pair of dressing forceps until its upper end penetrate through the internal os ; it is kept in place by a tampon of iodoform gauze placed below the external os in the vagina, and there allowed to remain. In a few hours the tent absorbs moisture, *swells*, and thus dilates the cervix sufficiently to invoke uterine contractions (pains).

This method secures preservation of the bag of water, which aids subsequent greater dilatation of the os and cervix uteri, and favors discharge of entire ovum—foetus, placenta, and membranes—all at one time ; and also tends to minimize the amount of hemorrhage.

2. *Puncture of the Amniotic Sac.*—The sac is ruptured by introducing a uterine sound, or some other similar instrument, into the cavity of the womb, and turning it about therein until the liquor amnii escape. The method is more often used criminally than for beneficent purposes. It is perhaps the worst

¹ *Sponge tents* are no longer used ; it is impossible to sterilize them thoroughly.

of all methods, and must certainly never be employed late in pregnancy when it is designed to save the child's life, for discharge of the "waters" subjects the soft and immature fetus to fatal compression by contraction of the uterine walls during delivery.

Surgical Method.—It has been recently recommended to treat the ovum as if it were a morbid growth, and remove the contents of the uterus by a surgical operation.

After *thorough disinfection* of the abdomen, vagina, and external genitalia, as well as of the hands and instruments of the operator, the patient is anesthetized; or instead of general anesthesia (should this be contraindicated) $\frac{1}{4}$ of a grain of cocaine may be injected with a hypodermic needle into both sides of the cervix. A speculum is introduced, the anterior lip of the uterus steadied by a volsellum forceps, while with a steel branched dilator (Goodell's) the os and cervix are slowly dilated to the extent of one or even two inches. The whole hand is then passed into the *vagina*, while the index finger slowly goes into the *uterus* until reaching the fundus, which last is pushed by abdominal pressure deeply down into the pelvic cavity. The entire ovum, membranes and everything, is then peeled or scraped from the uterine wall with the finger and extracted. In case the womb cannot be sufficiently depressed for the finger to reach the fundus, a long curette may be used to *separate* the ovum, and its extraction accomplished by the finger or ovum-forceps afterward. Ergot and compression may be necessary to control hemorrhage. Finally, the emptied womb is thoroughly washed out with a 1 : 5000 solution of bichloride of mercury or with a 3 per cent. solution of creolin, after which a drain of sterilized gauze is passed to the fundus, and the proceeding is finished in short order. The gauze is to be removed in sixty hours.

When the cervix is rigid and refuses to yield to the finger or steel branched dilator, the cervical canal (having been dilated as far as practicable by these methods) is stuffed with sterilized gauze, which after six or eight hours so far softens the tissues of the cervix as to allow of completing the required dilatation with the finger or instrument, when the operation is proceeded with as before described. While this method comports with the reigning surgical bias of the age, there are

no proofs as yet that it is better than other aseptic modes of managing abortion cases. After the fourth month *abortion* may be induced by the same methods employed for the induction of *premature labor*, now to be described.

Best Method of Inducing Premature Labor when It is Designed to Save the Child's Life.—After thorough asepsis of vagina, vulva, instruments, etc., pass into the uterus between its wall and the fetal membranes, with great care and gentleness, to avoid rupture of sac and disturbance of placenta, an elastic urethral bougie (more easily rendered aseptic than a hollow catheter) to a length of 7 or 8 inches within the os. Let it remain there (kept in place by a vaginal tampon of iodoform gauze) as a foreign body to invoke uterine contraction. Some of the gauze may be packed in the cervix uteri alongside of the bougie.

To ascertain the position of the placenta, with a view to avoid disturbing it with the bougie, it has been lately recommended to map out the Fallopian tubes and round ligaments; if they *converge anteriorly*, the placenta is on the *posterior* uterine wall; if they are *parallel* to the longitudinal axis of the uterus the placenta is on the *anterior* wall of the uterus.¹

In introducing the bougie the woman should be placed on her left side in the latero-prone position, with hips near the edge of the bed. A Sims speculum is used; the cervix steadied by a tenaculum or volsellum forceps in the anterior lip, while the bougie is passed up and guided into the os uteri; then let one finger follow it up to the internal os and deflect the point to one side, so as to avoid injuring the bag of waters. Thus guided by the finger of one hand it is pushed up with the other. With the os uteri of a primipara it may be necessary to dilate it with the steel branched dilator before inserting the bougie. Instead of using a speculum in the Sims position, the woman may remain on her back, and the bougie be passed up, grasped in a long pair of uterine dressing or polypus forceps, and guided in by the fingers as just described. If, in twenty-four hours, no effect be produced, (which rarely happens), take it out, and again introduce it in a somewhat different direction, and leave it as before. Uterine

¹ Leopold states that the correctness of this view has been verified by numerous Cæsarean sections.

contractions eventually occur, when the instrument is removed, and if the pains increase in strength, the case may be left to nature.

If the contractions be only feeble and do not increase in strength and frequency, accelerate both *them* and dilatation

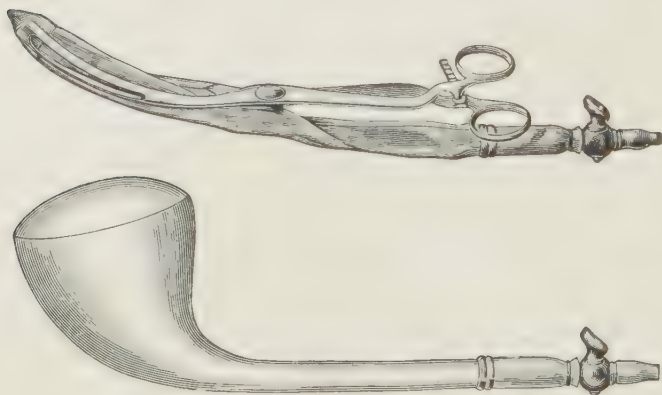
FIG. 262.



Barnes' bag.

of the os by introducing elastic dilators (Barnes' water-bags), first a small one, afterward larger sizes, into the cervix. No other measures will *generally* be required. One of Barnes' water-bags, with its attached tube, is shown in

FIG. 263.



Dilator and forceps of Champetier de Ribes.

Fig. 262. The bag is introduced (the woman having been placed on her back, her lower limbs flexed, and hips near edge of bed) by means of a uterine sound, the end of which is inserted into the little pocket fixed to the bag near its upper end, or it may be folded and grasped by a pair of dressing-forceps.

passed just into the cervix, and pushed up further with the fingers. It is next filled with sterile water (not with air) by a Davidson syringe, the capacity of the bag having been previously learned, so that it will not distend to bursting. A string tied tightly around the tube retains the water, or a stopcock may be attached, as shown in the figure.

A modified dilator, invented by Champetier de Ribes, differs from that of Barnes in being larger ($3\frac{1}{2}$ inches in diameter at the base), of conical shape, and made of *inelastic* water-proof silk. It is introduced with a special curved forceps, as shown in Fig. 263.

It remains *in situ* until expelled by the pains, when dilatation will be sufficiently complete to allow of delivery. In cases of pelvic narrowing this dilator must not be distended to its full capacity, but only so far as will allow it to pass easily through the contracted canal.

Voorhees, of New York, has devised an inexpensive conical bag, in sets of four sizes, to be used like that of de Ribes.

The dilating power of these bags may be increased, after their introduction, by fastening to them a weight of one or two pounds which hangs by a string over the footboard of the bed; thus steady traction and pressure against the resisting os uteri are maintained. If, when the os is *well dilated* with the larger bags, uterine contraction be still delayed, the membranes *may* be ruptured, but *then* delivery must be *hastened*, usually by getting down one foot by the Braxton-Hicks method of version, in order to save the child's life.

Other Methods: The Vaginal Douche.—Place the woman upon the bed, her hips near the edge of it and resting on a rubber cloth, in which is arranged a gutter to guide the returning fluid into a vessel on the floor. By means of a fountain-syringe, Davidson's syringe, or a rubber tube connected with an elevated vessel, direct a stream of warm water *against* the cervix uteri, continuously, for fifteen minutes, three times a day, at intervals of six hours. The nozzle of the syringe must go *against* the *neck*, never *into* the mouth of the womb. Temperature of the water about 100° F. From four to twelve or more injections may be necessary. The woman need not keep her bed before labor begins. A modification of the vaginal injection is known as Cohen's method.

Cohen's Method.— This consists in passing an elastic catheter between the membranes and uterine walls, and injecting warm water slowly, in quantity of seven or eight ounces, *into the uterus*, preferably near the fundus, until the patient feel some distention. Labor comes on much more certainly and rapidly than after the vaginal douche, but both these methods, for good reasons, have been abandoned, and are no longer used.

Uterine Injections of Sterilized Glycerine.—A recent method of inducing labor consists of injecting between the uterine wall and bag of waters from one to three ounces of *sterilized glycerine*. It acts by producing a rapid exosmosis of fluid from the amniotic sac or from the uterine wall, with consequent separation of the membranes and production of labor pains. The glycerine is sterilized by boiling. After a sufficient trial it has been found both unnecessary and dangerous; it is no longer used.

The use of ergot and other oxytocics; the injection of carbonic acid gas into the vagina; the induction of uterine contraction by electricity, galvanism, abdominal frictions, irritation of the mammary glands, have in turn all been resorted to for bringing on premature labor, but cannot now be recommended.

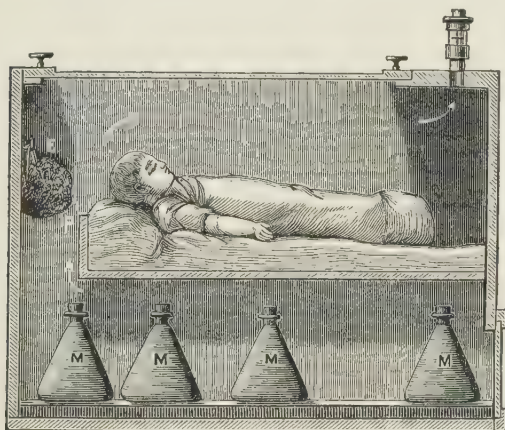
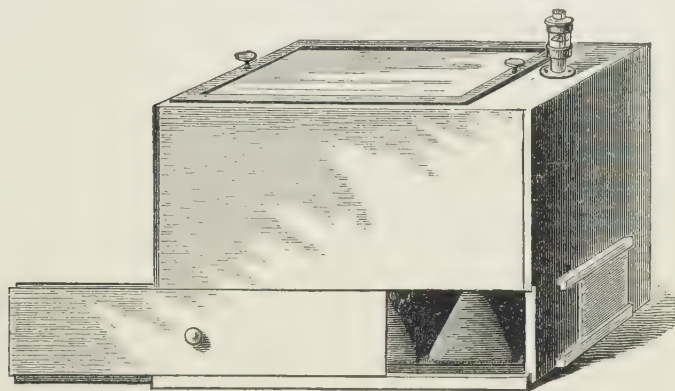
Whatever method is used, the main purpose of the operation, viz., that of saving the child's life, must be kept constantly in view, and since delay after rupture of the membranes, if prolonged, is likely to destroy the child, it should be delivered either by forceps or version, as soon as dilatation of the os uteri and other existing conditions render such a proceeding safely practicable.

TREATMENT OF PREMATURE INFANTS AFTER BIRTH.

The two great *desiderata* are warmth and food, to which a third might be added, viz., rest. Lay the child upon a mass of, and cover it with, cotton wool. Keep it near the fire, protected from changes of temperature. Handle it carefully in washing, the water used being as warm as 100° F. The mother's milk—given with a spoon if the child be too feeble to suck, or dropped in the mouth from a pipette—must be administered at frequent intervals, every hour, and without

a long fast during the night. Should the mother not have sufficient milk during first day or two, it must be obtained from a wet nurse, or artificial food be substituted.

FIG. 261.



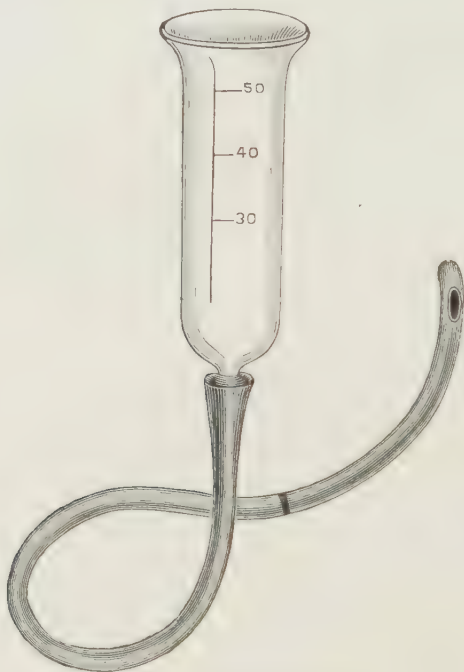
A simple incubator. M. Hot-water cans. E. Moist sponge. P. Child's bed; the arrows show currents of air. (From DAVIS, after AUVARD.)

The child's skin is extremely delicate ; hence it should have a daily bath (100° F.) not exceeding three or four minutes in

duration, and its napkins must be changed promptly, as soon as soiled by discharges from the bladder or bowel.

To maintain premature children at a uniform and elevated temperature, "incubators" have been employed. These consist of chambers with sufficient breathing space, in which the child lies, and the air of which is kept at the desired tempera-

FIG. 265.



Tube and funnel for gavage.

ture (90° to 98° F.) by artificial heat, supplied by another chamber having hollow double walls containing hot water surrounding the interior compartment containing the infant. The lid is of glass through which the child may be seen, and the apparatus contains contrivances for regulating temperature and ventilation at will. "Tarnier's incubator" and the

"apparatus of Credé" are now used in many maternity hospitals. Tarnier's incubator has been much simplified by Auvar, whose apparatus is shown in Fig. 264, page 487.

An incubator may be improvised by placing bottles of hot water or hot bricks or flat irons beneath and around the cotton-wool contained in the box or basket in which the child lies, the hot bottles, etc., being changed frequently. The success of this incubation-process requires the constant attention of a nurse, and largely depends upon the weight and prematurity of the child. Children weighing less than three pounds seldom survive; of those weighing four or five pounds many survive.

The process of "*gavage*"—artificial introduction of food into the stomach—has also been employed in infants too young and feeble to nurse with apparent advantage. A soft-rubber catheter with a small glass funnel at one end (see Fig. 265) is moistened, and the free end passed to the back of the tongue, which provokes a reflex act of swallowing, when the tube is quickly pushed on down into the stomach; now two, three, or more teaspoonfuls (according to age) of the mother's milk, previously made ready, are poured into the funnel, and as soon as it disappears by gravitation the tube is quickly withdrawn—there must be no waiting, or the child will vomit. With practice and expertness the whole proceeding may be done in fifteen seconds. The child rests on the nurse's lap with its head slightly raised during the operation.

CHAPTER XXIV.

PLACENTA PRÆVIA—HEMORRHAGE BEFORE AND DURING LABOR.

PLACENTA PRÆVIA.

PLACENTA prævia consists in implantation of the placenta abnormally near to, or more or less over, the internal os uteri. There are three varieties: (1) The border of the placental disk may be near the margin of the os without overlapping it, hence called "*marginal*"; (2) the placenta may be partially or (3) completely over the os internum, hence, respectively, "*partial*" or "*complete*" cases.

Causes.—Not certainly known. Probable explanations are: Displacement of ovum from its normal position and lodgment lower down, as after arrest of threatened abortion; abnormally low position of orifices of Fallopian tubes; large relaxed uteri of multiparous women, in which folds of decidua vera do not retain ovule near fundus when it first enters the womb; hence the undoubted greater frequency of placenta prævia in multiparæ. It is also more frequent in multiple pregnancy. Chronic endometritis is a predisposing cause, and the same may be said of myomata, carcinomata, and other diseases of the uterus.

Consequences of Placenta Prævia.—1. Liability to premature labor; only about one-third of the cases reach full term. 2. Tendency to malpresentation. 3. Fearful hemorrhage, generally coming on during the last twelve weeks of pregnancy, or when labor begins; the bleeding being earlier and greater according to the greater degree of placental encroachment over the os; in the marginal cases sometimes not until "term"; in complete ones, exceptionally, *before* the last twelve weeks. 4. Death of the child, due to asphyxia, premature delivery, hemorrhage, compression of cord during

version, or to prolapse of cord and its insertion near margin of placenta. 5. Liability to post-partum hemorrhage; 6. Danger of septic infection. 7. Morbid adhesion of placenta; in premature cases the tissue-changes in the utero-placental junction, normally preparing for separation at full term, have not yet taken place, hence so-called *morbid* adhesion is admitted to exist in 40 per cent. of all cases. Some say in a majority of the cases.

Symptoms and Diagnosis.—*Before labor* sets in, placenta prævia is generally unsuspected until the sudden occurrence of hemorrhage, which begins *without any known cause*, sometimes even at night during sleep, or while urinating in a chamber vessel. It may stop and recur again. The quantity varies with the amount of placental *separation* (which always precedes the bleeding). First attacks usually moderate; exceptionally, quarts of blood are lost, and death follows one or two recurrences; such cases are usually “*complete*” ones. The quantity is apt to increase with each recurrence.

During labor the bleeding begins early with commencing dilatation of the os. It may, in marginal cases, be arrested by rupture of membranes and consequent compression of bleeding surface by the presenting head. Labor pains usually feeble, and dilatation slow. To these symptoms must be added those due to blood-loss; syncope, restlessness, feeble pulse, cold extremities, vertigo, headache, etc. In fatal cases convulsions often precede death.

The *diagnosis*—clearly suspected from history and symptoms—is confirmed by vaginal examination, the irregularly granular spongy texture of the placenta being easily recognized by the finger passed into the os. In some primiparæ passing the finger to or through the internal os may be difficult or impossible; then, however, one side of the lower segment of the uterus may be felt, through the vagina, to be *boggy, soft, and enlarged* where the placenta is attached; and the pulsation of arteries may be felt in it. A stethoscope applied to cervix may reveal loud placental murmur. The sign ballotement is obscured. Diagnosis cannot be *positive* until the placenta is actually touched and recognized by the examining finger. During the first half of pregnancy a certain diagnosis is *impossible*. By skilful hands the spongy cushion of the placenta may be recognized (chiefly in head

presentations) by *abdominal palpation*. A region of the hard globe of the head feels obscured by the placental mass, while the part not covered by the placenta retains its usual hardness. This can only occur when the placenta is *not* situated *posteriorly*.

Prognosis.—Prior to the last twenty-five years, the maternal mortality in these cases used to be from 30 to 40 per cent. Since then, with the advent of aseptic midwifery and improved methods of treatment, it has been reduced to 4 per cent., and in some well-conducted hospitals, even to less than 2 per cent. Placenta prævia occurs once in about 1200 labors. The infant mortality still continues high—50 to 60 per cent. A good many infants born alive succumb soon after birth.

Treatment.—Whether the hemorrhage occur at full term, or several months before then, and the woman *is in labor*, there can be no question that *delivery*, by whatever method it may be judiciously accomplished speedily, is the proper principle of treatment, since it stops and prevents the recurrence of bleeding.

When the woman is *not* in labor, and the pregnancy has not reached the age of infant viability (twenty-eighth week), some advise palliative measures to control hemorrhage until that time arrive. But this is unsafe for the woman, and the child will seldom be saved by temporizing. The best rule is to *deliver as soon as practicable after the first occurrence of hemorrhage, whether the child be viable or not*. If labor have not begun, induce it. An exception may be made to this rule in hospital practice, a physician being *always present* to attend at once in case of hemorrhage recurring after its temporary cessation.

The best method of *arresting hemorrhage* and of *inducing labor*, when the os uteri is not sufficiently dilated to allow *any* method of immediate delivery, is to pack the vagina (and *cervix uteri* as far as practicable) with iodoform gauze, or any other sterilized gauze, and in case of emergency, strips of sheeting or of a towel, sterilized by ten minutes boiling, may be used instead of gauze.

This tampon, firmly applied, and kept in place by an "occlusion dressing" (see page 268), will *certainly* check hemorrhage, contribute to soften and dilate the cervix, and

will usually evoke uterine contractions, and so bring on labor. This kind of treatment will be most often called for in primiparæ and in premature cases, when the os uteri is too small for operative delivery. But the same thing may occur more rarely at full term, and in multiparæ.

If aseptically applied, the tampon may remain from four to ten hours, or even longer, unless strong pains occur, or blood begin to appear through the occlusion dressing, when it should be removed. If the cervix still remain too small for operative delivery, the tampon may be replaced, after a vaginal antiseptic douche. When the os uteri will admit two fingers, it is large enough for bipolar version, which is the method of delivery most usually adopted, for reasons to be now stated.

Delivery by the Braxton-Hicks Method of Version (Bipolar Version).—When the os uteri is as large as a silver half-dollar, pass the whole hand into the vagina, insert one or two fingers inside the cervix, and get down one foot by Braxton-Hicks bipolar version (described in Chapter XIX., pp. 380 and 381). As the leg, thigh, and breech are successively drawn down, while the dilating cervix yields, they *press upon the placenta, like a tampon, and stop hemorrhage*. Observe that this is the chief object and virtue of the method. Note, too, that a leg could *not* be brought down by *external* version, and that the os uteri is not sufficiently dilated for *internal* version; hence the bipolar method is the only available one. Hemorrhage having been thus controlled, there should be *no haste* in extracting the child. One hour, or several hours, may be required; traction on the leg should be just strong enough to maintain sufficient pressure of the child against the placenta to prevent bleeding, hence it must be in proportion to the readiness with which the dilating cervix yields. It would be quite possible to extract the body quickly, but the temptation to do this must be resisted. It is this hasty extraction that kills so many infants; the body is drawn through before the os is sufficiently dilated to readily admit the after-coming head, and, as in ordinary breech presentations, a few minutes' delay at this time is fatal from pressure on the cord. Moreover, extensive and dangerous lacerations of the cervix may occur from imprudent haste. In some cases the tissues of the cervix are especially fragile. Wright compares the condition to

that of "wet blotting-paper," but it is seldom as bad as this.

In doing bipolar version in *central* cases of placenta prævia, it may be necessary to plunge the finger right through the placenta and bring down the leg through the opening thus made. In other cases, the finger may penetrate the membranes, or enter through the space where the placenta has already separated from the uterus. From the great liability to septic infection, the aseptic technique must be most rigidly enforced in all cases.

Treatment by Rupture of the Membranes, Supra-pubic Pressure, Ergot, and Forceps.—While bipolar version, since it can be done before the cervix is much dilated, and since it stops hemorrhage and expedites delivery, is probably the method of treatment *most often* practised, it must be understood that there are other cases in which this method would be quite out of the question. For example, when the os uteri is fully, or pretty well dilated and dilatable, at or near full term, with strong pains, a good pelvis, and normal presentation, and particularly in "marginal" or "partial" cases of placenta prævia, simple *rupture of the membranes*, with discharge of the liquor amnii, may be all that is necessary to check hemorrhage. Under the circumstances mentioned, the *head of the child is forced* down upon the bleeding placenta, and *acts as a plug* to stop hemorrhage, just as the leg and body of the child did in the version cases. Should this pressure from labor pains alone be insufficient to control bleeding, an abdominal binder and manual pressure upon the fundus, together with small doses (10 drops every hour) of fld. ext. of ergot may be used to reinforce them, and the delivery may, if necessary, be completed by forceps. Rupture of the membranes should, of course, never be done when the child presents transversely, or in any other cases where version is likely to be called for.

Treatment by the de Ribes Bag.—By those who have become sufficiently dextrous in the application of this device (see Fig. 263, page 484) its use in certain hospitals has given such good results, especially in lessening the infant mortality, that it deserves separate consideration. It is used, when the child is alive and viable, instead of the bipolar version method, and in the same cases. That is to say, when the os

will admit two fingers, the bag is passed in through the ruptured membranes, or through the placenta itself (in "central" cases), and distended with water. Then by traction upon the bag—accomplished by a weight attached to it by a cord going over a pulley at the foot of the bed—the *bag itself acts as a plug* to stop hemorrhage and dilate the os, just as the child's leg did in the version method. By the time the bag comes away it will have dilated the os uteri sufficiently to admit of speedy delivery by forceps or version, should either of these be required. The distended bag is liable to displace a head presentation and change it into a transverse one, but this can be corrected by manipulation. In place of the de Ribes bag, the largest size of Voorhees' bag may be used.

The chief value of this method is to attain such a degree of cervical dilatation as will readily admit the after-coming head when version is done, thus lessening the infant mortality.

Treatment by Cæsarean Section.—While this operation has been done (again with the view of lessening the infant mortality), in certain cases where the child is viable and the mother in good condition, it is not likely to supplant the methods of treatment already described. In well-appointed hospitals, with skilled operators, it is quite admissible that in a few cases of very rigid cervix in uninfected primiparæ, with a child alive and near full term, the operation might be right and justifiable; otherwise not.

After the child is delivered, the placenta may follow spontaneously, but in many instances, owing to adhesions, the introduction of a rubber-gloved aseptic hand may be required to separate and remove the afterbirth. A hot antiseptic douche and a uterine tampon of iodoform gauze should then be used if hemorrhage continue. Hemorrhage from laceration of the cervix will require sutures.

Other Methods of Treatment Formerly Used.—*Barnes' method* consisted in passing the *hand* into the vagina, and one or two *fingers* as far as they will reach, into the *uterus*. The fingers, then insinuated between the placenta and the uterine wall, are swept around in a circle so as to *complete* the separation of *that part* of the placenta attached near the cervix, and whose *incomplete* detachment keeps the bleeding vessels open. It is often followed by retraction of the cervix and cessation of the hemorrhage, and is especially serviceable when the

placenta is placed *entirely* over the os. Rapid expansion of the cervix with Barnes' dilators and delivery by version may follow, if desired; or, there being no necessity for active interference (*i. e.*, no more bleeding), the case may complete itself without further assistance.

Nearly allied to Barnes' method is that of *Cohen and Davis*, viz.: Pass one or two fingers in between the placenta and uterine wall, on that side where the separation has begun, or where the attachment is least extensive; complete the separation on this side, and then let the fingers hook down the border of this loosened flap of placenta and pack it closely against the other side of the cervix. Then rupture membranes, give ergot, and hasten delivery. Should pains be strong with the head presenting, the latter may engage within the os, and, by its pressure against that side from which the placental flap was removed, plug the vessels and stop bleeding. Should the pains *not* be strong enough to force down the head in this manner, a foot may be brought down by version, and thus act as a plug to stop bleeding, as in the Braxton-Hicks proceeding first above described.

Simpson's method of treating placenta prævia consisted in completely separating and extracting the placenta, trusting to powerful uterine contraction for subsequent rapid delivery of the child—a trust so seldom realized in practice that Simpson's plan scarcely allows a chance for the child's life. Complete separation of the placenta, however, will often arrest the hemorrhage, and may, therefore, be of use when the child is dead, or not viable, or pretty sure to die from prematurity of the labor; or when great exhaustion on the part of the woman, and the state of her pelvis and soft parts, contra-indicate delivery by version.

Anæmia, syncope, or collapse from loss of blood will require stimulants, etc., as more particularly described under post-partum hemorrhage, in the next chapter.

The use of ergot in placenta prævia early in labor is *not* objectionable, as in ordinary labors, because in most cases the child is *small*, being *premature*. Before using it, however, it should always be ascertained that there exists no *other* mechanical obstruction, such as transverse presentation, pelvic narrowing, tumors, etc. Should the pregnancy be at term and the child *full sized*, the use of ergot is not so safe, yet the risk

of using it even here may be less than the dangers of delay from inefficient pains.

After delivery ergot must be given, and for several days, to prevent post-partum hemorrhage; and a 2 per cent. solution of creolin should be injected into the vagina twice a day to prevent septic infection.

HEMORRHAGE BEFORE DELIVERY, BUT WITHOUT PLACENTA PRÆVIA.

Partial separation of the placenta, with hemorrhage, may occur during the latter months of pregnancy or after labor has begun, when the organ is *normally situated*. It may result from blows, falls, or other mechanical violence; pathological degeneration of the placenta or utero-placental junction; profound anæmia, albuminuria, and multiparity with frequent child-bearing are probable predisposing causes. It sometimes results from nephritis during pregnancy, as well as from other acute diseases, viz., variola, scarlatina, typhoid fever, and acute yellow atrophy of the liver. Seldom occurs in primiparæ.

Traction by a short cord may produce it; as may also marked diminution of the utero-placental area following the birth of a first twin child, or the sudden discharge of liquor amnii in extensive polyhydramnios.

Symptoms.—Blood from the partially separated placenta may flow from the vagina (*external hemorrhage*), or it may accumulate in and distend the uterus (*concealed hemorrhage*). The severity of the symptoms varies directly as the amount of bleeding, whether inside or out, they may also be sudden or gradual, and occur either before (usually) or during labor.

In *external* cases there is blood-flow, shock, symptoms of blood-loss, perhaps *some* distention of and pain in the uterus, and on vaginal examination no placenta prævia can be found. Unlike placenta prævia, there may be a history of previous injury; blows, falls, jars, etc.

In “concealed” cases, symptoms of blood-loss, distention of the uterus (from accumulating blood), and tearing pain in the abdomen, really in the stretched uterine wall, which may be so severe as to produce profound nervous shock. The pain is more moderate in slow distention of the uterus, with small and

gradual accumulation of blood. The collapse and pain occurring during labor may be mistaken for rupture of the uterus. The latter, however, will be accompanied by recession or mobility of the presenting part, and escape of the child, wholly or partially, into the abdominal cavity. Rupture is usually preceded by *violent* uterine contractions.

Prognosis.—Extremely grave, especially in concealed cases, where the diagnosis may be uncertain and efficient treatment postponed. The maternal mortality used to be 50 per cent.; it is now much less. The infant mortality is from 50 to 60 per cent.

Treatment.—Except in very mild and moderate cases, no expectancy is admissible. Delivery offers the only port of safety.

Success in the treatment of any case (whether “external” or “concealed”) largely depends upon the presence of *efficient uterine contractions*. If, in a given case, one could anticipate difficulty and delay in securing good contractions, a prompt and clean Porro operation would give the best chance for both mother and child. This has been done successfully even under less favorable circumstances, and is a recognized method of treatment.

In a concealed case, before labor begins, when the large pregnant uterus is still further distended with effused blood, the conditions for efficient uterine contraction are at their worst, the womb is weakened by overdistention, the woman by hemorrhage and shock due to suffering, a vaginal tampon would do no good, except in so far as it might excite uterine contraction. Rupture of the membranes in letting out concealed blood would only lessen intrauterine pressure, and thus promote further internal bleeding. These are the cases that die. If a prompt Porro operation be *not* done, the only other hope is to excite uterine contraction by ergot, massage of the uterus, an abdominal binder, and vaginal tampon.

Uterine contractions having been secured, the whole aspect of the case is changed for the better. The membranes should now be ruptured, for the *contracting* uterus will leave no space for further blood accumulation. Ergot, massage, binder, and tampon may still be continued, to maintain and increase the contractions, until the os uteri become sufficiently dilated for delivery by version or forceps. To hasten dilatation, all

methods have been, and may be used, viz., the de Ribes bag, Bossi's instrumental steel dilators, Harris' method by digital manipulation, and incision of the cervix, as the operator may prefer.

After delivery the placenta should be removed, and the uterus packed with iodoform gauze to prevent post-partum hemorrhage, which is not unlikely to occur in a womb that has been overdistended and a woman enfeebled by hemorrhage and shock.

CHAPTER XXV.

POST-PARTUM HEMORRHAGE—"FLOODING."

HEMORRHAGE after delivery of the *child*, and either before or after delivery of the *placenta*,¹ is a most dangerous complication, sometimes causing death in a few minutes, especially when unprepared for and irresolutely managed. Hence, necessity of fixed principles and decided remedies, used without hesitation, in the hour of need. Gooch well said: "No physician should have the assurance or hardihood to cross the threshold of a lying-in chamber who is not thoroughly conversant with the remedies for flooding." It consists of bleeding from the open mouths of uterine blood channels from which the placenta has, wholly or in part, been separated.

Causes.—Correctly appreciating the causes of flooding permits *prevention*, which is better than cure. Excluding, for the present, the rarer cases in which bleeding occurs from laceration of the uterus, vagina, and vulva, the one condition, above all others, that leads to flooding is *deficient uterine contraction*—sometimes a *total* want of it—*inertia uteri*; hence the term "*atonic*" hemorrhage. Why should the womb remain inert after the child is born? Its muscular walls may be worn out by a *long labor*; or partially paralyzed, like an overfull bladder, from previous *overdistention* due to amniotic dropsy or plural pregnancy, etc. Too *rapid labor*, as by injudicious haste in artificial delivery, or from abnormally enlarged pelvis, especially when preceded by overdistention of the womb, produces it. The uterine muscular wall may be congenitally *deficient in development* (as in precocious mother), or *malformed*, or bound down on the outside by *peritoneal adhesions*, or *texturally degenerated* from previous inflammation,

¹ The terms "*post-partum* or *post-partial*" may seem to be, strictly speaking, inapplicable to cases in which the *placenta* is still *undelivered*, for the third stage of labor is not yet over; hence it is not *after parturition*. Some authors make this distinction. There is no real use in doing so. If the term *post-partum* be defined as after *child-birth* (and it often is) this will include the cases with retained placenta.

or *numerous and quickly successive labors*, as in elderly women. Weak uterine muscles may occur from *general weakness of the woman*, due to constitutional disease, severe previous illness, exhausting discharges, heat of climate, etc.

Distention of bladder or rectum causes *sympathetic* uterine inertia, as may also *violent mental emotion*.

Retention of placenta—whether from morbid adhesion, large size of the organ, or irregular (“hour-glass”) contraction of the womb—*mechanically* prevents close contractile approximation of the uterine walls. In the case of morbid placental adhesion, the *partially separated* blood-channels are kept open and *cannot retract* to prevent bleeding, as they normally should do. It is liable to occur, as already stated, in placenta prævia. A short or coiled funis may lead to separation of the placenta before birth of the child. The placenta follows the delivery of the child almost at once, and with it comes, sometimes, a profuse hemorrhage—blood that had accumulated in the uterus between the time of placental separation and delivery. Occasionally fibroid tumor of the uterus, when situated near placental site, will produce hemorrhage.

Those who have flooded in previous labors are apt to flood again. This is observed in plethoric women, subject to profuse menstruation, and is further explicable by existence of conditions, as to pelvis, womb, etc., previously mentioned, which are permanent and irremovable.

Further causes are conditions which interfere with formation of, or which tend to move and displace coagula in the mouths of the bleeding vessels. The blood-changes of profound albuminuria and wasting diseases, possibly the so-called “hemorrhagic diathesis,” may retard formation of coagula; and formed or half-formed clots may be displaced by strong arterial tension and pulsation, or by the patient suddenly rising, “sneezing, coughing, laughing, vomiting,” etc. (Lusk).

On the whole, the one main cause is *deficient uterine contraction*. When a contracted womb continues to bleed there is probably laceration.

Symptoms.—Gushing of blood from the vagina, either immediately or some time after birth of the child, or still later, after delivery of placenta. Quantity variable; moderate or fatal—a trickle or a flood. Absence, partial or complete, of hard uterine globe on hypogastric palpation. The womb may be

soft and greatly enlarged from accumulation of blood in its cavity, with little or no external flow ("concealed hemorrhage"). In either case there are symptoms of blood-loss: deathly pallor; cold extremities; feeble, frequent, thready, or imperceptible pulse; gaping, restlessness, dyspnoea, and hunger for air; thirst, and even hunger for food. In the worst cases syncope, loss of vision, convulsion, death.

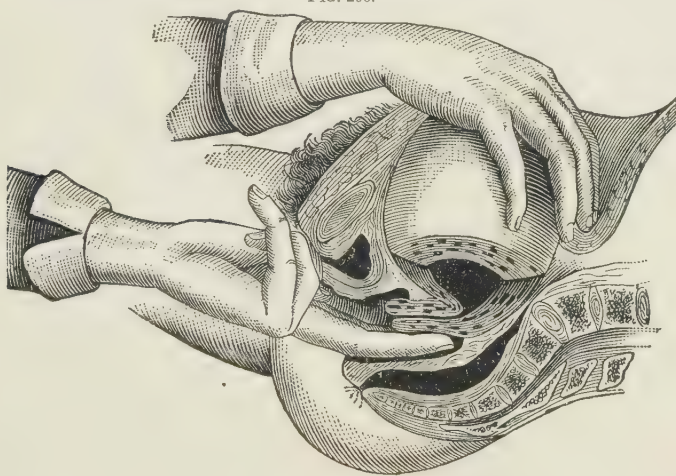
Treatment—Preventive and Preparatory Measures.—The necessity of guarding against relaxation of the uterus and promoting uterine contraction during the third, and near the end of the second stage of labor, by manual pressure has already been insisted upon as a precaution in every case. Every obstetrician should prepare for flooding during second stage of labor, whether it be likely to occur or not, by providing beforehand a good-working Davidson syringe, ice in pieces the size of an egg, brandy, sulphuric ether, carbolic acid, ergot, a solution of morphia, a can of iodoform gauze, a hypodermic syringe filled with fluid extract of ergot, or two grains of ergotin in solution, together with pitchers of hot and cold water, an empty basin, a fountain syringe, and a bed-pan, all placed within easy reach of the bedside; a preparation neither tedious nor troublesome, but which may save a life.

When the hemorrhage occurs, grasp the uterus, *without a moment's delay*, through the abdominal wall, and knead it with the finger-ends to secure contraction, while an assistant injects hypodermically, a drachm of fluid extract of ergot, or two grains of ergotin in a drachm of water into the outside of the thigh. Let the nurse give a dose of ergot by the mouth, and also put the child to the breast. With proper previous preparation and self-possession, all this can have been done within thirty seconds.

Should the womb not yet contract and the flooding continue, let one hand continue to grasp the fundus uteri on the outside, while the other (again without hesitation) is passed quickly, but gently, into the vagina and uterus. (The hands must, of course, be rendered *aseptically clean*.) Now the uterine wall is between the two hands, and may be pressed between them, while the outside one applies friction to the fundus; or, again, the hand inside may be gently *twisted around* so as to irritate the womb and produce contraction. *If the placenta be un-*

delivered, it must be removed at once, either by grasping and squeezing the fundus firmly by the outside hand, or the hand inside grasps the placenta bodily, having previously separated any remaining adhesions, and gently withdraws it, the hand outside meanwhile compressing the uterus with sufficient firmness to squeeze its anterior and posterior walls together. *If the placenta be delivered* before the flooding, and large blood-clots occupy the cavity, these must be fearlessly removed, and the obstetrician's hand take their place. A special mode of grasping the uterus (bimanual manipulation) may be tried as follows: Press the finger-ends of the outside hand deep in between the umbilicus and uterus, so that the latter, resting in the

FIG. 266.



Bimanual compression producing ante flexion, etc.

palm, may be pushed down and forward against the pubes, while the other hand (or two fingers of it), passed high up along the posterior vaginal wall, presses the lower segment of the womb—in fact, its cervix—forward toward the symphysis pubis: thus by a sort of temporary ante flexion the canal of the neck is closed and no blood can come out, while the pressure above prevents enlargement of cavity and accumulation within. It also stimulates contraction. (See Fig. 266.)

A perfectly clean aseptic sponge, or, preferably, a similarly clean bit of rag or small pocket-handkerchief, saturated with spirit of turpentine, or whiskey, passed into the womb and squeezed so that the spirit comes in contact with the uterine walls, are efficient stimuli to uterine contraction. A cloth containing pure chloroform, passed into the uterus and allowed to remain there for a time, has also been used successfully. The old but well-tested remedies, of a rolled, gashed lemon and a sponge filled with vinegar, being introduced and squeezed while in the uterine cavity, have of late been objected to as being aseptically unclean. They are, however, powerful excitants of uterine contraction. The vinegar can be sterilized by boiling, and in cases of emergency it is usually obtainable in every household. A lemon can be rendered aseptic on its exterior by immersion in a bichloride solution, and that septic germs inhabit its interior structure is at least improbable and certainly not demonstrated.

One of the best internal methods for arresting this hemorrhage is irrigation of the uterine cavity with hot sterilized water (115° to 120° F.) by means of a Davidson or fountain syringe, care being taken that the nozzle of the instrument is free from germs and its tube completely emptied of air before being used; a bed-pan receives the returning water.

The external parts should be smeared with carbolized oil or vaseline, to prevent pain caused by contact of such hot water with the skin.

In every case the child, whether washed or not, may be put to the breast by an assistant, in the hope that suction of the nipples will produce reflex uterine contraction.

Contraction may sometimes be induced by rolling a piece of ice on the abdomen over the fundus at intervals, or pouring cold water from a height upon it, or flapping it with a wet towel.

Of late years a safe and efficient method of arresting hemorrhage has been found in the uterine tampon of iodoform gauze, or of gauze soaked in a 3 per cent. creolin mixture. Remember, it is a tampon in the *uterus*, not in the vagina. The gauze is soaked in a 20 per cent. iodoform solution and sprinkled with iodoform powder. Three strips of gauze, each 2 inches wide and 3 yards long, are prepared. After disinfecting the vagina with a 2 per cent. creolin solution, or with

a 1 to 3000 solution of corrosive sublimate, the patient is placed crosswise on the edge of the bed, and the tampon introduced by seizing the cervix uteri with the hooks of a volsella forceps and pulling it down to the vulva while one end of the gauze strip is grasped by a pair of long uterine forceps and carried *to the fundus*; then the forceps are withdrawn and several folds of the strip introduced until the womb be filled—completely and *firmly* filled—from fundus to external os. When the genital passage and vagina are large, so that there is plenty of room, the womb may be pushed down by pressure of the left hand over the fundus until the os become visible at the vulva, when two fingers of the right hand push up the gauze into the uterine cavity until it be full. The rough gauze is thought to produce irritation of the uterine muscles, and hence contraction. The tampon may remain twenty-four hours, when it is easily removed by traction on one end of the strip. This method is so sure, safe, and simple, that instead of making it a last resort, it may be used at once, if ergot and manual compression fail to arrest the bleeding. After the uterus is well packed, the vagina also may be tamponed; it acts as an additional excitor of uterine contraction. But a *vaginal* tampon must *never* be used *alone*; in these cases it would cause the uncontracted empty womb to fill up with blood, thus converting an external hemorrhage into an internal “concealed” one, and enlarging instead of diminishing the uterine cavity.

The application of perchloride of iron to the interior of the uterus has, for good reasons, been abandoned. It endangers both infection and embolism.

Compression of the abdominal aorta has been employed with good results as a temporary measure in urgent cases. It cuts off the blood-supply to the flooding uterus, stimulates uterine contraction, and lessens risk of fatal syncope by keeping blood in the brain that would otherwise flow downward.

It has been recently recommended, particularly in cases “where the bleeding results from large arterial vessels that have undergone atheromatous degeneration,” to open the abdomen and *remove the uterus* by supra-vaginal amputation, a method that few obstetricians in private practice would willingly undertake, and that still fewer women, exhausted by previous hemorrhage, would be able to survive.

Another recent suggestion is to invert the uterus completely through the vagina, encircle it near the neck with a rubber tube or bandage of iodoform gauze, and thus arrest bleeding. After six hours, the tube (or bandage) is removed, and, there being no recurrence of hemorrhage, the inverted uterus is replaced. Practice has not yet demonstrated the utility of this operation.

To epitomize the most useful and most available remedies, and the order of their succession, we may say, *first*: External and internal manipulation, ergot, and putting child to breast; *second*, irrigation of uterine cavity with hot (120° F.) sterilized water; *third*, firm *uterine* tampon of iodoform gauze.

In every case when the bleeding has been arrested and good contraction of the uterus produced, the organ must be supported on the outside by firm and equable compression over the abdomen, in order to maintain its retraction and prevent recurrence of hemorrhage. A well-adjusted abdominal binder, with compresses over the top and sides of the uterus, should be carefully applied. Lusk suggests a sack partially filled with moistened sand or common salt as a reliable compress and one easy to obtain. A small basin padded inside with napkins, placed over the fundus, is another similar device.

Fritsch has devised a mode of compression which not only prevents the *recurrence* of hemorrhage, but which (he claims) will also *stop* it, even without a tampon, or any other *internal* manipulation—the latter being extremely desirable to prevent infection. The womb is grasped by passing the hand well *behind* the fundus and then *lifted* as high as possible and forcibly anteflexed against the *upper* and *anterior* surfaces of the pubic bones, any contained clots being of course expressed by this proceeding. A large pad (folded towels, or something similar) is now forced down behind the womb almost to the pelvic brim, and kept firmly in place by an abdominal roller bandage; thus the uterus is actually compressed against the *anterior* abdominal wall and pubes—its anterior surface being, as it were, turned down over the *mons veneris*.

In all cases it should be ascertained that inertia of the womb is not kept up by a full bladder or rectum.

To restore the circulation after hemorrhage has ceased, or to prevent impending fatal syncope during its continuance, stimulants, nutrients, and *opiates* are required. A drachm of

brandy, whiskey, or sulphuric ether may be given hypodermically, and repeated at required intervals; or strychnia, gr. $\frac{1}{30}$, or nitro-glycerine, gr. $\frac{1}{100}$; morphia hypodermically to promote cerebral congestion, and tincture of opium and brandy internally in full doses, together with strong beef *essence*, milk, etc., at short intervals. In feeding the patient, the smallest *quantity* (only a teaspoonful every one or two minutes) may be all the stomach will bear without vomiting; this to be increased as larger portions are tolerated. If, in spite of care, vomiting occur, opiates, stimulating and nutrient enemata, or hypodermic injections may be used, to the temporary exclusion of mouth-feeding. Admit plenty of fresh air from open windows. Remove all pillows, to keep the head low, and elevate the foot of the bed, thus promoting gravitation of blood to the brain and medulla. The head must not be raised from its dependent position, to give food or medicine, nor for any other purpose, for fear of syncope and *fatal heart-clot*, until reaction have taken place.

Compression of the brachial and femoral arteries, or binding the four extremities with Esmarch's bandages, like aortic compression, may keep enough blood in the brain, temporarily, to prevent death, while stimulants get time to act.

When death is so near at hand that respiration seems about to cease, flick the face, neck, and breast with a wet, cold napkin; it invokes additional inspirations, and is usually grateful to the patient.

When stimulants and the other measures mentioned fail to produce reaction, transfusion may save the patient. The transfusion of blood, or of fresh cow's milk, formerly used, have of late been superseded by the more easily available proceeding of infusing into the circulation a saline solution. As much as a quart of the following mixture may be slowly introduced into a vein:

R. Sodii chloridi,	3iss;
Sodii bicarb.,	gr. xv;
Aq. destillat.,	Oij.—M.

Lusk uses a simple solution of common salt, five grains only, to a pint of water. The fluid may be passed into a vein of the arm (usually the median cephalic) by means of an

elevated funnel, or fountain syringe, from which depends a tube surmounted at its lower end by a small canula for penetrating the opened vein, or into the femoral artery, after the method of Dawbarn. But these operations require surgical skill and are not devoid of danger.

The *simplest and best* method of replenishing the depleted bloodvessels and restoring the circulation (far safer than transfusion into an artery or vein), is to inject large quantities of the saline solution hypodermically into the cellular tissue, either in front of the chest, or behind, between the scapulae or into the nates. Two or three pints of "normal salt solution" (*i. e.*, three grains of common salt to the ounce of water—approximately 100 grains, or a small teaspoonful to water, one quart) is prepared (the water having been previously sterilized by boiling) and placed in a fountain syringe, the tube of which is surmounted with a large hypodermic or exploring needle which is plunged beneath the skin, and the solution allowed to flow into the cellular tissue by gravitation. Whatever method is used, the solution must always be hot—about 100° F. Half an hour or more may be required to allow the gradual introduction of a sufficient quantity of the fluid.

The slow injection of a pint or more of normal salt solution, high up into the rectum, through a suitable tube, may be used with, or instead of the hypodermic method, and answers almost as well. An ounce or two of whiskey may be added to the enema.

After reaction has been established, the woman will suffer, perhaps for several days, with neuralgia, headache, and photophobia, due to cerebral anæmia; hence iron, quinine, and nutritious diet will be required, and opium to relieve the pain.

SECONDARY POST-PARTUM HEMORRHAGE.

Secondary post-partum hemorrhage (puerperal, or remote hemorrhage) may occur within three or four days, or even as many weeks, after labor. Its *causes* are retained blood-clots, membranes, or pieces of placenta, or (perhaps unsuspected) a placenta succenturiata, in the uterus. It may also arise from violent mental emotion, or physical exertion, or use of alcoholic stimulants soon after labor. Fecal accumulation, retroflexion of the womb, laceration of the

cervix, inversion, thrombus of cervix or vulva, fibroid and polypoid tumors, and certain blood-changes, such as those of profound anaemia, uraemia, or miasmatic poisoning, are additional causes. One case occurring eight days after labor, followed the inhalation of chloroform and aconite for insomnia.

Symptoms.—Bleeding may come on suddenly (quantity variable), stop, and recur at intervals. It may or may not be accompanied by fetid discharges and septicæmic symptoms.

Treatment depends upon cause, which must be thoroughly investigated. In case of retained clots or secundines, remove them with an aseptic, rubber-gloved hand or fingers (better than the curette) irrigate the uterus with a hot antiseptic solution, and if necessary, pack it with iodoform gauze.

If the os uteri will not admit the hand, as may happen some weeks after delivery, it must be dilated with the fingers, or Hegar's dilators. Ergot may be given to insure firm uterine contraction. Other etiological factors—uterine displacement, laceration, inversion, fecal accumulation, etc.,—must of course receive appropriate treatment.

Hemorrhage coming on *very* late, that is some months after labor, *may* be due to deciduoma malignum, this malignant growth rarely developing after labor, just as it does after hydatidiform mole. (See Chap. XI, p. 221.)

In any case absolute rest and mental quietude, with tonics (especially tinct. ferri chloridi) and nutritious liquid diet will be required.

MORBID RETENTION OF THE PLACENTA.

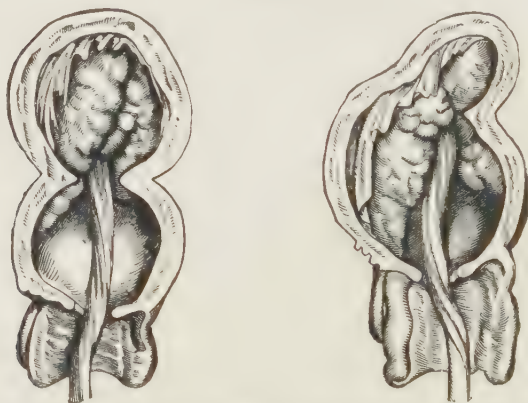
Morbid retention of the placenta, from causes other than inertia uteri, has been referred to as an additional factor in the production of post-partum hemorrhage. It is commonly due to *morbid adhesion* of the placenta to the uterine wall, in consequence of placentitis, or inflammation of the utero-placental junction, having taken place during pregnancy; or there may have been chronic inflammation of the lining of the womb (endometritis), with hyperplasia of connective tissue, before impregnation. Abnormal placental adhesion is often associated with, and is indeed a cause of *irregular "hour-glass" contraction* of the uterus (see Fig. 267), which consists in a spasmodic contraction of some of the circular mus-

cular fibres of the womb near its middle, the placenta being retained above the constriction, through which last the umbilical cord may be traced up from the os externum.

Spasmodic contraction of the os is another condition by which delivery of the placenta may be delayed.

Treatment.—Spasm of the os, and spasm of the circular fibres higher up, may both be overcome by *steady, continuous pressure* with the hand, the finger-ends being approximated into a cone or one finger put in at a time until all have entered, when the hand may be gradually forced through the constriction, counter-pressure being always made by the other

FIG. 267.



Hour-glass contraction of uterus, with encystment of the placenta.

hand upon the fundus. The placenta is then, if *not adherent*, simply grasped by the hand and gently withdrawn *during a contraction of the uterus*, aid being afforded by pressure on the fundus and by ergot. If the organ *be adherent*, the morbid adhesion must be broken up and the placenta completely separated before withdrawal is attempted. A finger—one or two—must be insinuated between the uterus and placenta at some point already partially separated, or if no partial separation exist, at a point where the placental border is thick, and then passed to and fro transversely, through the utero-placental junction, acting like a sort of blunt “paper

knife," until separation be complete. Another mode is to find or make a margin of separation as before, and then peel up the placenta with the finger-ends, rolling the separated portion toward the palm of the hand upon the surface of the still adherent part, as one might lift up the edge of a buckwheat cake and roll it upon itself until it were turned completely over and separated from the plate on which it lay. Strong fibrous and fibro-cartilaginous (rarely even partially ossified) bands may require to be pinched in two between the thumb-nail and index-finger. Great care is necessary to avoid peeling up an oblique layer of uterine muscular fibre, which might split deeper and deeper until leading the finger-ends through the uterine wall into the peritoneal cavity. Should such a splitting begin, leave it alone and recommence the separation at some other point on the placental margin. It is sometimes only possible to get the placenta away in pieces. These should be afterward put together and examined to indicate what remnants are left behind. It may be quite impracticable to get out every bit, but small remnants or thin layers too firmly adherent for removal do not distend the womb enough to create hemorrhage from their bulk, and the subsequent danger of septicæmia from their decomposition may be obviated by injecting warm (2 per cent.) creolin water into the uterus twice daily, until everything have come away.

In cases where the placenta is retained from its *unusually large size*, hook down one edge of it with the fingers to insure its presenting endwise instead of flat like a button buttoned in a button-hole, and then make downward and *backward* traction—*aided by abdominal pressure*—to draw it through the os uteri. To make the *backward* traction referred to, dig one or two finger-ends into the substance of the placenta, if it cannot be grasped firmly enough by the finger-ends, and manipulate as if attempting to *push it toward the sacrum*. A part of the organ having thus been made to bulge out of the os, release the fingers and hook them into the placenta again, higher up, and so on until it have entirely passed into the vagina.

In any case where the hand is *passed into the uterus* to extract a placenta, the most rigid aseptic technique must be observed. The danger of infection is accentuated by the hand (necessarily) being *outside* the amniotic sac, between it and the

uterine wall, in *immediate contact* with the open mouths of bloodvessels at the placental site. In extracting a *child* (as in version) the hand is *inside* the sac, the membranes being between the hand and uterine wall; hence the increased danger in placental cases is evident.

Introducing the hand into the *vagina* for extraction of the placenta is sometimes sufficiently painful to cause objection and resistance on the part of the woman, the vulvar orifice being tender, or perhaps more or less lacerated. A little firmness of purpose, sometimes lacking in the young practitioner, coupled with moral encouragement of the woman, and gentleness of manipulation, will remedy the difficulty.

CHAPTER XXVI.

INVERSION OF THE UTERUS.

THE womb may be inverted in various degrees, from a simple indentation of the fundus to its being turned completely "wrong side outward," and hanging upside down in the vagina. It usually begins by "*depression*" of the fundus, the top of the uterus being indented like the bottom of an old-fashioned black bottle; this may go on until the fundus reach and begin to protrude through the os into the vagina ("*partial inversion*"), or the protruding part may come through more and more, until the whole organ be turned inside out ("*complete inversion*"). (See Fig. 269.)

Occasionally inversion begins at the neck, the fundus being then inverted last. (See Fig. 268, page 514.)

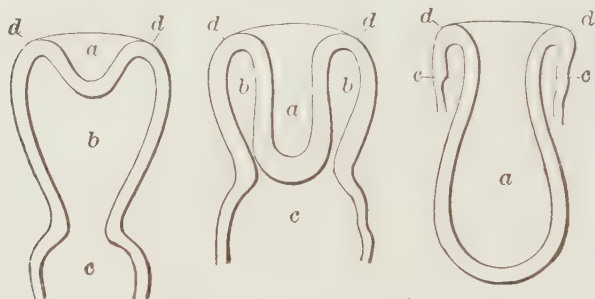
Causes.—Under any circumstances inversion of the uterus is rare, but it is usually the result of mismanagement—traction on the cord, or upon an unseparated adherent placenta, during the third stage of labor, especially when the womb is not well contracted. Other causes are an *actually* short umbilical cord, or one that is *practically* short from coiling round the child; sudden delivery, particularly while standing, and when the uterus is overdistended and relaxed; violent straining or coughing efforts after delivery; forcible and injudicious pressure upon the fundus from above, whether by the hand or heavy compresses. In short, a *relaxed* womb may be inverted, either by pressure from above or by traction from below; inversion of a *well-contracted* uterus is well-nigh impossible.

A very few cases have occurred after abortion and in unimpregnated uteri with polypi whose pedicles were attached near the fundus, but these last belong to gynecology.

Symptoms.—Hemorrhage, faintness, shock, pain, vesical and rectal tenesmus. Abdominal palpation reveals "*depression*" of fundus, and bimanual examination, in "*partial*"

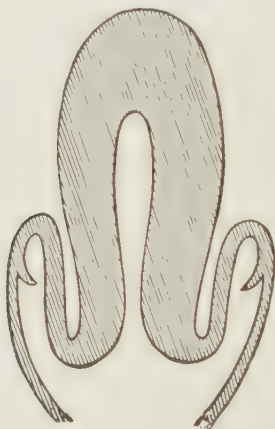
and "complete" inversion, demonstrates respectively partial or complete absence of uterus from its normal position in the pelvis. Diagnosis may be obscured by a full bladder (pro-

FIG. 268.



Three degrees of inversion. *a.* Depression of fundus. *b.* Uterine cavity. *c.* Vagina. *d* to *d.* Normal line of fundus before inversion.

FIG. 269.



Inversion beginning at the cervix. (After DUNCAN.)

duced by the inversion), but using a catheter will relieve this difficulty. Vaginal examination discovers uterine tumor occupying the vagina, together with the placenta, if this last have not been previously delivered.

A fibrous polypus (the only thing liable to be confounded with an inverted womb) may be diagnosticated from the uterus by its *complete insensibility*, its *total want of contraction when handled*, and by *following its pedicle through the os uteri up into the uninverted uterine cavity*, which last may, in any case of doubt, be demonstrated with the *uterine sound*. Feeling the womb in its proper position, through the abdominal wall, shows the organ is not inverted. Uterine inversion is hardly likely to be mistaken for polypus, except when the organ remains inverted for months (sometimes for years) after labor, becoming reduced in size by involution; such cases are called "chronic inversion," and properly belong to gynæcology.

The *prognosis* of uterine inversion during labor is always serious. The great immediate danger is profuse hemorrhage, the *more* profuse when associated with inertia uteri, and perhaps some spasm of the os. Much depends upon the early reduction of the inversion. Every minute adds to both danger and difficulty. Exceptionally, the placenta may be sufficiently adherent to prevent great hemorrhage.

Treatment.—"Depression" of the fundus and "partial" inversion may be readily reduced by passing the hand into the womb and pushing out the indented portion, while the organ is then stimulated to contract.

When inversion is "complete," reduction may still be easy if attempted at once, but not so after delay. If the placenta be still wholly or in great part adherent, it should be attempted to push it back with the uterus, the closed fist being pressed against the dependent fundus, on which the placenta forms a cushion, while *counter-pressure is made with the other hand over the abdomen*. When the bulk of the placenta interferes with reduction, and when it is already in great part detached from the womb, its separation may be completed before pushing back the fundus. When constriction of the os and other causes have produced swelling and congestion of the inverted uterine body, the latter must be compressed between the two hands steadily for a few moments to lessen its bulk before reduction is attempted; or this may be done more effectually by bandaging the inverted organ with a strip of iodoform gauze.

Should spasmodic constriction of the os render reduction impossible even by *steady, firm* pressure, anæsthesia may be

resorted to to relax the spasm, but the main principle of success in these cases is to maintain *continued pressure*, without any intermission, for five, ten, or fifteen minutes, and with like continued *counter-pressure*.

After reduction, the hand must not be withdrawn from the uterine cavity until the organ have been made to contract, and the placenta, if pushed back with the womb, must then be separated and withdrawn, as in other cases.

To further prevent a return of the inversion, the uterine cavity should be irrigated with hot water—115°–120°F.—a quart or more may be required; it secures contraction and arrests bleeding.

When the dependent inverted fundus refuses to yield readily to manual pressure, one or both of the angles of the womb, where the Fallopian tubes enter, may be first indented in the operation of reduction. Inertia and hemorrhage resulting from, or complicating inversion, require the remedies for post-partum hemorrhage. (See Chapter XXV.)

The strictest antiseptic technique must, of course, be observed in all these manipulations, and after the inverted womb is finally replaced, its cavity must be washed out with the creolin solution.

CHAPTER XXVII.

RUPTURE OF THE UTERUS, VAGINA, ETC.

RUPTURE OF THE UTERUS.

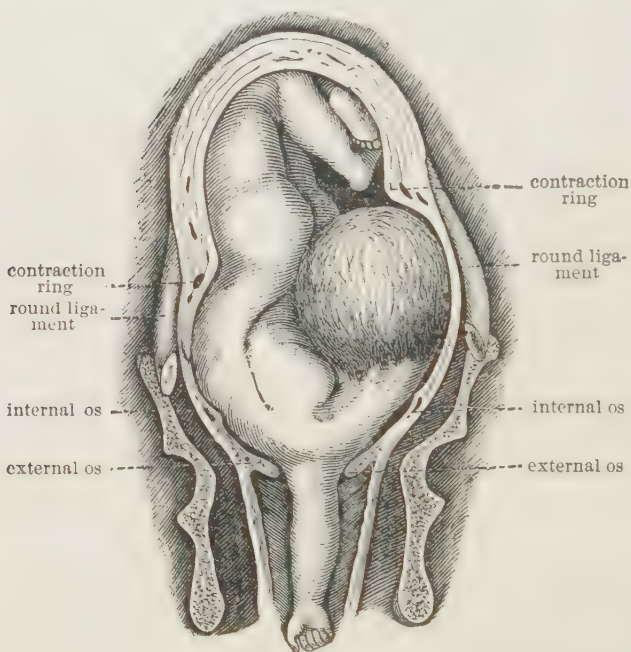
RUPTURE of the uterus may occur in any *direction*, transversely, longitudinally, or both; in any *position*, fundus, body, or neck, most frequently toward the last; and in various *degrees*—that is, through the muscular wall without rupture of the peritoneum—“*incomplete rupture*”—or through both peritoneal and muscular coats—“*complete rupture*.”

Causes.—*Strong uterine contraction coupled with mechanical impediment to passage of child*—conditions existing in transverse presentations, pelvic deformity, or contraction, and with large size of fœtus, especially in the fetal head, as in hydrocephalus, obstruction from fibroid or other tumors, etc.; the danger in all of these cases is increased by *ergot*, which is sometimes unfortunately given. Occasionally rupture occurs *without* obstruction to passage of child; it is then explained by *tissue degeneration*—fatty, fibrous, or tubercular—of the uterine wall; or the tear may occur at the site of a previous rupture, or through the old scar of a former Cæsarean section. It may also result from traumatic injury following blows, falls, squeezing, etc. The uterine wall is, rarely, nipped and pinched between the presenting part of the child and abnormal sharp edges of bone projecting into the pelvic canal, by which a solution of continuity—the beginning of rupture—is produced. Multiparity, and the thinning of the uterine walls due to frequent childbearing, are predisposing causes. Ante-flexion, anteversion, cervical obstruction, and lateral obliquity of the uterus constitute other instances of mechanical hindrance to labor liable to be attended with rupture. The womb may be ruptured by violent and unskillful manipulations during version and forceps operations. Inflammatory

changes in the uterine tissues, due to prolonged pressure between the fœtus and the pelvic walls, conduce to rupture—even ulceration and gangrene may occur.

Symptoms.—Although rupture generally occurs suddenly and without warning, the existence of conditions mentioned under the head of “causes” ought to be sufficient to indicate

FIG. 270.



Arm presentation with threatened rupture of thinned lower segment of uterus
(After SCHRÖDER.)

danger of the accident. In the more usual cases of mechanical obstruction there occurs, some time before rupture, a remarkable thinning and stretching of the lower segment of the uterus, while the upper and middle segments of the womb are thickened, the line of division between the thin and thick

portions constituting a perceptible ridge or furrow, commonly known as the "*ring of Bandl*," or more familiarly of late as the "contraction ring." This condition is shown in Fig. 270 (page 518), illustrating the result of prolonged labor in an arm presentation. On one side fully half of the uterus,

FIG. 271.



Thinning of lower segment of uterus in obstruction from hydrocephalus.
(After BANDL.)

extending from the shoulder of the child to the top of its head, is thinned as described. The same condition appears in Fig. 271, showing obstruction from a large hydrocephalic head; the thin, stretched part of the uterus extending from the os uteri, on a level with the pelvic brim, up to the child's arm.

It is this thin portion that is especially liable to rupture. The increased thickness of the upper segment is explained by muscular retraction, and by what has been termed "*migration*" of the muscular layers—they separate from each other; some slip up by contraction and leave the wall below thinner, but thicken the part above. (See Figs. 270 and 271, pages 518 and 519.) *Preceding* rupture, therefore, the ring of Bandl, running obliquely or transversely across the uterus, may be discovered by abdominal palpation, and as the pains—usually rapid and violent—progress, the ring gets higher up toward the fundus; ¹ the *round ligaments* may also be felt as *tense cords* through the abdominal wall. The *vaginal* wall may also be tense and stretched. Such conditions indicate *danger of impending rupture*. They are often coupled with symptoms of general exhaustion from prolonged effort, viz., small, quick pulse; hurried breathing; anxious expression; pronounced mental despondency or despair, etc.

When rupture actually occurs the typical symptoms are a sudden sharp pain in the womb (caused by its tearing), sometimes accompanied by an audible noise; sudden and simultaneous cessation of labor pains; a sensation as if warm fluid (really blood) were being diffused into the abdomen; violent shock and collapse, indicated by pallor, feeble and frequent pulse, cold extremities, fainting, hurried respiration, vomiting, etc. (usually due to hemorrhage into the peritoneal cavity). On *vaginal examination* the presenting part of the child is found to have receded from its former situation, owing to partial or complete escape of the fetus through the rent into the abdominal cavity, where, by *abdominal palpation* it may be felt as an irregular-shaped, movable tumor, more or less distinct from another tumor formed by the partially contracted uterus. Blood may or may not escape from the vagina. A loop of intestine may prolapse through the rent and be found by vaginal examination.

The foregoing array of symptoms would leave no room for doubt in diagnosis. But when rupture takes place more gradually, or is "*incomplete*"—i. e., when the muscular coat *only* is ruptured, the peritoneum remaining intact, the symp-

¹ Before labor begins, the retraction ring is situated about 3 inches above the *os internum*; in impending rupture it may be felt through the abdominal wall 2 inches above the *pubes*.

toms are less decided. The child will *not* have escaped—at least completely—into the abdomen, but will be contained in a stretched pouch of peritoneum, so tense that the different parts of the child cannot be recognized in it by abdominal palpation, whereas in “*complete*” rupture the foetal parts are *easily* recognized and can be easily *moved* about, resting loosely, as they do, immediately beneath the abdominal wall. The presenting part may or may not have receded. In a gradually progressive rupture, labor pains may continue and force the child gradually through the enlarging rent. In some cases the presenting part becomes *impacted* in the pelvis, so that it *cannot* recede.

Prognosis.—It must be understood that rupture (laceration) of the *vaginal portion* of the cervix uteri may, and frequently does, occur during labor without any necessary immediate danger to life; but in these the tearing does *not* involve the peritoneum, and escape of blood, etc., into the abdominal cavity.

Rupture involving any portion of the womb *above* the vaginal part of the cervix is a different affair. The prognosis is here most grave. Death may ensue rapidly, either from profound shock or hemorrhage into the peritoneum, or, surviving these dangers, fatal peritonitis and septicæmia may shortly follow. The maternal mortality much depends upon the severity of the case, the extent of rupture, and the treatment adopted. Formerly it was stated only one out of six cases survived, but by the timely performance of laparotomy the results have become so much more favorable that over half the women are saved. The foetal mortality is still greater, survival of the child being a rare exception.

Treatment.—Before the occurrence of rupture, but when existing conditions indicate an evident liability to the accident, every means of *prevention* must be adopted. If possible, the mechanical obstruction to delivery must be removed, and the pains lessened by anæsthesia; then the uterus must be emptied without delay by *forceps*, if this be practicable; by *craniotomy*, *decapitation*, or *embryotomy* in suitable cases (the child will usually have died from prolonged pressure), or by whatever method the “*passage*” and “*passenger*” will allow. As to *version* in any case of *impending* rupture, it should *not* be attempted; it would be almost certain to *produce* rupture.

After rupture has occurred, especially if it be "complete" and extensive, and the child should have escaped, wholly or in great part, through the rent into the abdominal cavity, laparotomy should be done at once, child, placenta, blood-clots, etc., being removed through the abdominal incision; the peritoneal cavity cleansed with hot saline solution; the rent in the uterus repaired by suture; or in case of an infected uterus, or one that will not contract, or in which the rupture cannot be well secured, the entire uterus should be removed.

In cases complicated with laceration of the bladder, or by prolapse of an intestinal loop that cannot be replaced *per vaginam*, laparotomy is again a necessity, the prolapsed gut being drawn up and the bladder sutured from above.

In cases of *incomplete* rupture, when the rent is small, and the uterine contents have not invaded the peritoneal cavity, delivery should be done by forceps or embryotomy *per vaginam*, here again *version* would be almost certain to complete the rupture. After delivery of child and placenta in these cases, the rent should be plugged with iodoform gauze, and ergot given to control hemorrhage and corrugate the ruptured wound; the uterine cavity having been previously cleansed with a hot sterile salt solution; the gauze to remain twenty-four or forty-eight hours.

In cases where the obstetrician is *not* a surgeon, and surgical skill cannot be readily obtained, is there anything beside cœliotomy that can be done in the bad, "complete" cases, first before mentioned? Something must be done quickly; about one-half the fatal cases die within twenty-four hours from shock, hemorrhage, or sepsis. Unless delivery be accomplished in some way speedily, all will die. Under such circumstances, the hand *may* be passed in to grasp the feet (even passed through the rent into the abdominal cavity), and the child and placenta delivered through the vagina. Then the cavities of the uterus and abdomen should be cleansed by irrigation through the rupture and finally a long strip of iodoform gauze passed through the rent into the *peritoneal cavity*, enough to form a large pad (or splint) on the *outside* of the uterus, over the site of rupture, a continuation of the gauze strip (all in one piece) occupying also the *inside* of the uterus as a tampon. A binder over the abdomen compresses the abdominal pad against the uterine wound.

Day by day, little by little, the strip of gauze is drawn out *per vaginam*, until in the course of a week (more or less) it is all removed.

The results of this treatment have been so far successful with proper skill and asepsis that when the better plan of surgical interference is unavailable, it affords a pleasing resort for the *unskilled* obstetric surgeon in the emergencies mentioned. In fact some of the reports have shown favorable results almost equal to those of *cœliotomy*. But statistics are unreliable; no two sets of cases are alike.

The dangers and conditions of complete uterine rupture are much the same as those of a ruptured tubal pregnancy. The first immediate danger is hemorrhage; the control of which is one of the main objects of *every* method of treatment. By *cœliotomy*, the source of bleeding is made openly visible and can be secured. Sometimes, when the rupture is in the lower uterine segment, it may be possible to clamp, or ligate the bleeding vessels through the vagina, using a suitable speculum.

When the child has been delivered without *cœliotomy*, the placenta may have passed through the rupture into the abdominal cavity. To get it back, use traction on the cord with the hand in the uterus, one or two fingers hooking into the placenta through the rent, when it has thus been drawn within reach.

After delivery, stimulants and opiates will be required to counteract shock and collapse from hemorrhage, with absolute rest (as already described under post-partum hemorrhage), and every precaution taken against septic infection.

From the dreadful mortality following rupture of the uterus the importance of *prevention* in the different cases, when it is likely to occur, cannot be too ardently accentuated. Thus, in impending rupture with cross presentation, decapitate; with hydrocephalus, perforate; in breech presentations, deliver with blunt-hook; in cases of pelvic narrowing, the required operative methods must be done *without delay*. As a *general rule*, when the lower segment of the womb is *greatly thinned*, version is contra-indicated.

RUPTURE (LACERATION) OF THE VAGINAL PORTION OF THE CERVIX UTERI.

Slight superficial lacerations are very common, and often unrecognized. Even considerable ones pass unnoticed by the obstetrician more frequently than they would if properly sought for, as they should be after labor is over. Occasionally they extend up to the utero-vaginal junction, or into the vaginal wall. Sometimes transverse in direction (though generally longitudinal); pieces of the os may hang downward in the vagina, and rarely an entire ring of the vaginal cervix may be separated.

Causes.—Distention by the presenting part of the child during labor; rough manipulations during version, forceps, and other operations; incarceration of the anterior lip of the os between the head and pelvis. Tissue-changes preventing dilatation of the os, and primiparity, especially in elderly women, are predisposing causes.

Symptoms.—Hemorrhage, more or less profuse, according to the extent of laceration, the latter to be diagnosticated by digital examination, or, if necessary, by ocular inspection with the speculum.

Treatment.—Slight lacerations get well rapidly without treatment. In more severe ones hemorrhage may be controlled by vaginal injections of hot (120° F.), sterile water, or by a tampon of iodoform or alum gauze. Extensive cervical lacerations should be united at once by sutures of catgut, silk, or silkworm-gut; this prevents the subsequent occurrence of congestion, inflammation, and hypertrophy, etc., of the cervix, which may require restoration of the laceration by sutures, etc., months or years afterward. The suturing may be done with the aid of a Sims speculum; or the womb may be pushed down by abdominal pressure from above until the cervix become visible at the vulva, or pulled down by volsella forceps.

Carbolized injections into the vagina for a few days after labor, when laceration exists, should always be employed to prevent absorption of septic matter by the raw surfaces.

LACERATION OF THE VAGINA.

Lacerations of the vagina itself, or of the vaginal orifice, are recognized by digital examination or inspection. Rarely, superficial or moderately deep lacerations occur near the *anterior* commissure, involving the nymphæ, vestibule, urethra and its meatus, sometimes with considerable bleeding. They require aseptic cleanliness—dusting with iodoform—and, if deep enough to cause hemorrhage, sutures of fine silk, which may be removed in four or five days.

RUPTURE OF THE TISSUES OF THE VULVA.

Rupture of the inner tissues and bloodvessels—without any necessary laceration of skin or mucous membrane—may occur either during or after labor. Blood is immediately extravasated, causing the labium to swell rapidly, and constituting a hæmatoma or thrombus, to be now described.

THROMBUS OF THE VULVA.

A tumor, bluish in color, elastic or fluctuating, accompanied by sharp pain, usually on one side, forms rapidly; sometimes of sufficient size to prevent delivery mechanically. It may burst and lead to profuse or even fatal external hemorrhage. Extravasation may extend upward outside the vaginal wall to the uterus, or even to the cellular tissue of the iliac fossa, or behind the peritoneum to the kidneys.

The *prognosis* is variable, according to the extent of the injury and extravasation. Death may result from hemorrhage, or from decomposition of retained clots and septicæmia. In many cases of moderate extent, absorption of the effused blood and recovery take place.

Treatment.—During labor, delivery should be hastened—preferably by forceps, and this *early*—before the thrombus has had time to grow very large. If its size prevent delivery the tumor must be incised, the clots turned out, subsequent hemorrhage controlled by compression or pledgets of aseptic cotton or gauze, and delivery by forceps rapidly completed. After labor, when the thrombus has been opened, artificially or otherwise, styptics and compression may still be required to prevent further bleeding. If delivery have been completed

without opening the tumor, it must be left alone for absorption to take place. Should suppuration occur, as sometimes happens in a few days, the part must be incised to give exit to pus and clots, and antiseptic treatment of the wound adopted to prevent septic infection. In all cases absolute rest in the recumbent posture and the avoidance of straining efforts of every kind are indispensable, to prevent recurrence of hemorrhage. The bleeding (or extravasation) may also be controlled by vaginal hydrostatic pressure, an elastic rubber bag or Barnes dilator filled with ice-water being introduced into the vaginal canal for a few hours subsequent to delivery; carbolyzed washes to be used after its removal.

RUPTURE OF THE PERINEUM.

Causes and mode of prevention of this accident during labor have already been considered (See Chapter XII.)

Every woman ought to be carefully examined after delivery by inspection of the parts, to ascertain if perineal laceration exist.

Slight fissures of the posterior commissure, or of the fourchette in primiparæ, usually heal of themselves without treatment. Extra aseptic cleanliness is, however, advisable. Even tears of apparently considerable size shrink almost to nothing when the tissues have recovered from the distention of parturition, as they do in a short time. The extent of rupture may be either seen or made out by passing a finger into the rectum and thumb into the vagina, so as to hold the remaining recto-vaginal septum between the two. Extensive lacerations often involve the sphincter ani, posterior vaginal wall, and rectum. For convenience of description, lacerations of the perineum have been divided, according to their extent, as follows: Those extending from the posterior commissure *half-way* to the anus are called lacerations of the *first degree*; those extending to the anus but *not* involving its sphincter, the *second degree*; and those extending through the sphincter ani into the rectum are lacerations of the *third degree* or "*complete*" ruptures. Rarely, a "*central*" perforation (without any tearing of the posterior commissure of the vulva) takes place between the two openings of the vagina and rectum, through which the child may pass.

While the *diagnosis* of laceration and its degree is made by inspection and digital manipulation, the *symptoms* of *pain* and *soreness* at the seat of injury, and more or less bleeding from the wound will, of course, be present.

Treatment.—Unless the laceration be quite insignificant, the treatment consists in bringing the freshly lacerated surfaces together by silk or catgut sutures *immediately after labor*. This is to be done whether the sphincter ani be torn or not. In fact, the more extensive the laceration, the more the necessity and greater advisability of stitching up the rent. In bad cases, requiring *extra* surgical skill—not immediately available—a delay within twenty-four hours may be justifiable to obtain it, and would not make very material difference, apart from disturbing the woman when she ought to be at rest.

In lacerations of the first and second degrees (*not* involving the sphincter ani and rectum) the operation is not difficult. The woman is laid across the bed, her hips brought to the edge of it, her lower limbs held by assistants and flexed in the lithotomy position. Anæsthesia by ether, or local anæsthesia by injecting a 4 per cent. sterilized solution of cocaine, may be used, if necessary, to keep the patient still. The parts are cleansed and a pledget of sterile cotton or gauze pushed up the vagina to stop any flow from the uterus obscuring the wound. The sutures (preferably of aseptic silk) are passed with a moderately curved needle about two inches long, as follows: Beginning at the posterior end of the laceration (that nearer the anus), the needle enters the skin near the edge of the wound and follows a circular course until its point appears at the very bottom of the laceration (a finger of the other hand in the rectum guarding against its penetrating that canal); it then enters the opposite side of the laceration at the bottom of the wound and comes out of the skin opposite its point of entrance, having followed a similar circular course to that pursued on the other side where it first went in. The ends are *loosely* tied or secured by catch-forceps, until the requisite number of sutures are passed in a similar manner (half an inch apart), when the wound is again cleansed, the vaginal plug removed, and the sutures tied tightly enough to coapt the parts without injurious constriction, the order of succession in tying being that in which the sutures were passed.

In "complete" lacerations—those of the *third* degree—through the sphincter ani to the rectum, the operation is more difficult. The rectal tear is first stitched with *catgut* sutures (a short, curved needle being used) and going through the rectal wall only. The sutures are tied on the inside, so that the knots are on the mucous membrane of the bowel. They begin from above and come down to the sphincter ani, the cut ends of which are drawn out with a tenaculum while the sutures penetrate them. These *catgut* sutures need not be removed; they will digest in the tissues and disappear of themselves. The posterior wall of the vagina is next sutured with fine silk, from above downward toward the hymen. Finally, skin sutures through the perineum itself, including muscles of the pelvic floor (as just described for lacerations of the first and second degrees) complete the operation. The silk sutures may be removed in about a week. Antiseptic dressings are applied as after an ordinary labor, extra care being taken to keep the wound aseptically clean by daily irrigation with the creolin solution.

LOOSENING OF THE PELVIC ARTICULATIONS.

Loosening of the pelvic articulations of the pubic symphysis and sacro-iliac synchondroses occasionally occurs, either from pathological changes in the joints, or from great violence during forceps and other modes of artificial delivery, or both conditions exist together. The *symptoms* are, at the time, pain and increased mobility of articulations, demonstrated by grasping the two iliac bones near the anterior extremities of their crest, one in each hand, and moving them slightly to and fro, transversely, in opposite directions. After getting up, pain may be absent, but the patient is unable to walk, except with difficulty. If two fingers be passed into the vagina and placed behind the pubic symphysis, and the thumb in front of it, while the patient, standing, rests her weight first on one leg and then on the other, or sways her body from side to side, movement of the pubic bones against each other may be recognized.

Treatment.—Rest in bed upon the back, and support of the pelvic walls by a circular bandage of strong canvas or strip of rubber adhesive plaster about three inches wide, passing

round the body between the anterior superior spinous processes of the ilia and trochanters; it must go just *below* the spinous processes so as *not* to press upon them. It should be worn for weeks or months after getting up. It may be made continuous with or attached to a pair of short breeches or tights fitted on the upper part of the thighs to prevent slipping up. Recovery usually results.

CHAPTER XXVIII.

MULTIPLE PREGNANCY, HYDROCEPHALUS, AND OTHER ENLARGEMENTS OF THE CHILD.

MULTIPLE PREGNANCY.

THE simultaneous existence of two or more fetuses in the womb is termed "multiple" or "plural" pregnancy. The number of ova may be two, three, four, or five, named, respectively, twins, triplets, quadruplets, and quintuplets. Reported cases of more than six are not well authenticated. Twins occur once in about seventy-five cases; triplets once in about five thousand; quadruplets and quintuplets are extremely rare.

FIG. 272.



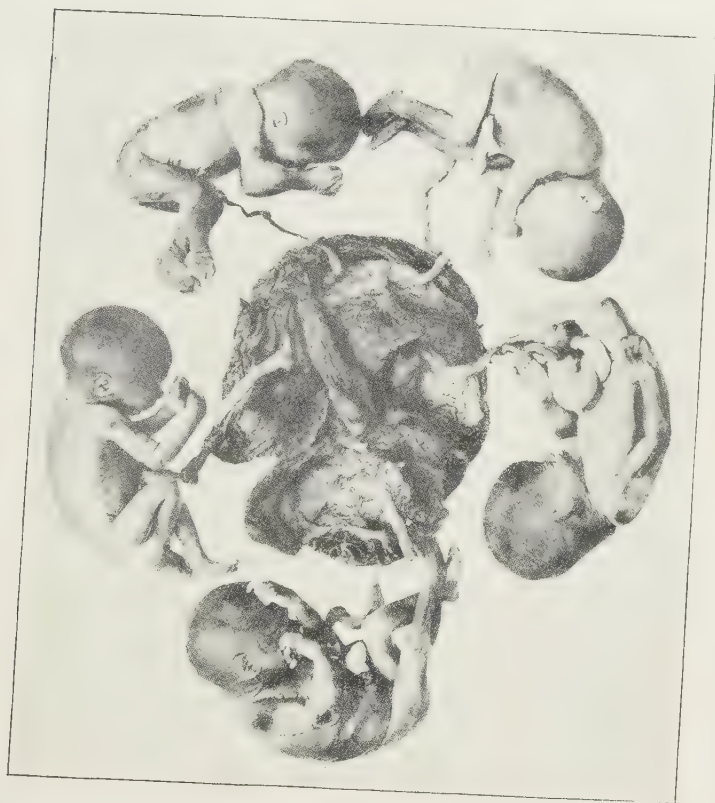
A case of sextuplets. (FROM KERR AND COOKMAN.)

In the case shown (Plate III) four of the fetuses were females, one male.

A few sextuplets are on record (Fig. 272). Jellett figures such a case in his "Manual of Midwifery," (p. 809).

Plural pregnancies are produced by two or more ovules entering the uterus and becoming impregnated about the same time. One ovule may come from each ovary, or two from the same ovary. In the latter case both ovules may come from one Graafian follicle, or each from a separate one. Again, one ovule may contain two germs, like a double-yolked egg from the fowl. These several modes of origin explain the

PLATE III.



Case of Quintuplets.

Published by Dr. G. C. Nijhoff in the "Journal of Obstetrics and Gynecology of the British Empire," July, 1904.

observed variation in the arrangements of the placenta and foetal membranes in different cases. Generally each ovum (in twin cases) has its own sac of amnion and chorion, which comes in contact with that of the other as growth advances; but the two sacs do not amalgamate; they remain separate till birth. In these there are two placentae, usually separate from each other, though they may be near together, or partially united. In other cases each ovum has its own amnion, but both are contained in one chorion. In these the two placentae are fused together, or the two umbilical cords may be united before reaching the placenta. Rarely both foetuses are contained in one amnion, as well as in one chorion. Here, again, the placentae are united in one mass. Two ova contained in one chorion are of the same sex.

The fact that the vessels of the two placentae and of the two cords may inosculate with each other (but which cannot be made out before delivery), leads to an important modification of the management of labor in twin cases, to be mentioned presently.

The growth of the embryos in twin cases is seldom exactly equal, and sometimes the difference is very great, one child appearing fully developed while the other remains very small. One foetus may die and be thrown off prematurely, while the other remains till full term; or the little dead one may still remain *in utero*, and come away at full term with the live one. These variations are due to conditions favoring the nutrition and circulation of one foetus at the expense of the other, such as folds or compression of the cord and compression of the placenta. When the two foetal circulations inosculate in the cord or placenta, one foetus having a stronger heart than the other, favors its better nutrition and development. In this way *acardiac* monsters are produced.

Occasionally one child remains for days or even weeks after the birth of the first one before it is delivered, and thus completes its development. Such cases are best explained by the existence of a double uterus.

Plural births generally occur a little before full term, the degree of prematurity increasing with the number of foetuses. In twins only a few weeks may be wanting of the usual period, quintuplets are always abortions; the others are intermediate.

Diagnosis.—The certain diagnosis of twins before one child

is born is sometimes difficult, but the following data will often be sufficient to render a diagnosis probable, and in some cases, when they are all available, a positive diagnosis may be reached. On *inspection*, the abdomen appears large in size and irregular in shape; the lower region of the abdominal walls just above the pubes is often swollen from localized oedema. An S-shaped sulcus indicating line of division between the two fetal sacs may sometimes be seen on the abdomen. (See Fig. 273.)

FIG. 273.



Twins; one head, one breech. The crosses A and B indicate points of greatest intensity of heart-sounds.

On *palpation*, the skilled hand discovers *persistent tension* of the uterine wall—*i. e.*, in an ordinary (single) pregnancy the womb becomes of a *wooden hardness* during contractions of the organ, but *soft and pliable* between the contractions, while in a womb overdistended with twins the organ becomes

hard during contraction, but does *not* get soft and pliable during relaxation ; an *intermediate degree of permanent tension remains* between the contractions, which is neither wooden hardness nor pliable softness.

In twins there are four fetal poles—viz., two heads and two breeches. Palpation reveals one pole at or below the brim, another in an iliac fossa, and one (or two) somewhere toward the fundus ; or they may be situated differently. The resisting planes of *two backs* may be made out ; and the movable small parts (limbs) may be felt at such divers and widely distant parts of the uterus as to make it inconceivable that they all belong to *one* child. Further signs : Exaggeration of those conditions of pregnancy due to pressure of the gravid uterus ; the impossibility of *ballotement* ; the recognition of two fetal heart-sounds, not synchronous with each other, heard loudest at two different points on the abdominal surface, and becoming feeble or inaudible between these points.

After one child is born, the existence of another is readily made out by the still large size of the womb ; by feeling the child through its wall over the abdomen ; and by a vaginal examination, recognizing the bag of waters and presenting part of the second infant.

Women who have borne twins once are likely to do so again. The tendency to plural births is also hereditary in some cases, and may be conveyed by the *father* ; hence a previous history of plural births in the family may be of *some* value as a means of diagnosis.

Prognosis.—Delivery of the first child usually tedious from inadequate labor pains, due to overdistention of the uterus, and from force of uterine contraction being necessarily diffused through bodies of both children, instead of being concentrated upon the presenting one. Delay is greater when the first child presents by the breech, especially so in delivery of the after-coming head. Prolongation of labor, large area of placental surface, and overdistention of the womb, predispose to inertia uteri and post-partum hemorrhage. Malpresentations are more frequent than in single births. In about half the cases both children present by the head ; in one-third of the cases one by head and one by breech ; in one-ninth, both by the breech ; and in one-tenth, either one or (rarely) both children present transversely.

Excluding the complications of malpresentation, the occurrence of twins, with proper management, need not preclude a favorable prognosis in the great majority of cases.

Treatment.—Tie the placental end of the cord when one child is born, to prevent possible hemorrhage from the second child, owing to inoculation of vessels between the two cords or placentæ. Let the placenta alone until after delivery of second child, unless it be spontaneously expelled before then, when it may be carefully removed. Should *both* placentæ be expelled before the birth of the second child (which rarely happens), speedy delivery is necessary to save the yet unborn fœtus from suffocation and to stop hemorrhage from the placental site, which is liable to occur.

The alleged danger of mental shock from telling the woman she is to have a second child, is seldom serious, especially when she is told its delivery will be short and easy.

After one child is born there usually succeeds an interval of rest from labor pains for fifteen minutes, sometimes for half an hour or an hour, when contractions again come on, and the second child is easily expelled, the parts having been thoroughly dilated, and the second child being usually smaller than the first. During the interval, when rest is advisable for recuperation of the (perhaps exhausted) uterus, examination must be made to ascertain the presentation, and correct it if transverse.

After an hour, or before then if the uterus be *not* exhausted by previous prolonged effort, the membranes, if intact, may be ruptured, and the womb manipulated through the abdomen to produce contractions.

In case of hemorrhage, convulsions, feebleness of the fetal heart, or any condition rendering immediate delivery necessary, forceps may be applied if the head have descended into the pelvis, and version if it have not. In either case, extract the child slowly, so as not to leave an empty relaxed womb, every means being taken to secure simultaneous uterine contraction.

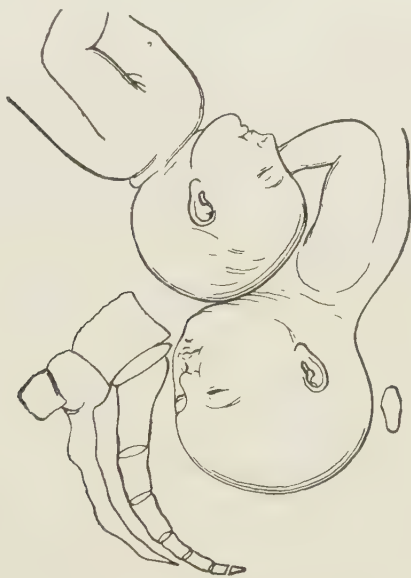
When both children are delivered, extra care is necessary to overcome inertia and prevent post-partum hemorrhage.

When the first child presents transversely, it must, of course, be changed by version: but should a necessity for speedy delivery arise in any other presentation, the first child should

not be delivered by version (which would be liable to entangle the two cords, as well as occasion locked heads), but by forceps.

Treatment of Locked Twins.—When both children are contained in one amniotic sac, or when, there being two sacs, both have ruptured early in labor, both children may present and enter the pelvis together, and thus get locked and prevent delivery.

FIG. 274.



Locked twins, both heads presenting.

When both heads present *at the brim*, one may be pushed up out of the way by combined internal and external manipulation, and forceps then applied to the other to bring it down into the pelvic cavity.

When both heads have *passed the brim*, push back the second one and apply forceps to the first (the lower) one. Should this be impracticable from the heads having descended too far, the lower head, and then the other, may be successively

delivered by forceps. If this method fail craniotomy may be required, preferably on the first (lower) head, the second being more likely to survive. The same mode of treatment may be necessary when one head, having passed the brim, is arrested by jamming of the thorax against the second head, either at or above the brim. (See Fig. 274.)

When pushing back the locked presenting parts appears impossible, it may still be made easy, in some cases, by placing the woman in a knee-chest position, which should always be tried before any serious operation; the parts go back by

FIG. 275.



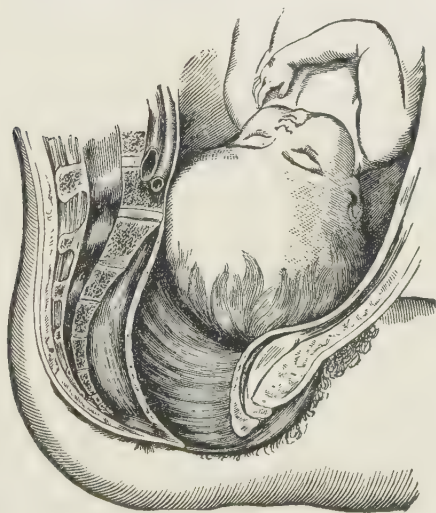
Locked twins, one breech, one head.

gravitation. When the first child presents by the breech and is delivered as far as the head, the latter may remain above the brim, owing to the head of the second child having descended into the pelvic cavity, the head of each child resting against the neck of the other, so as to lock or lap the chins together and prevent further progress. (See Fig. 275.)

Diagnosis of the exact arrangement of the complication having been made by the hand in the vagina, several different methods of delivery are available, selection of either being a matter of judgment determined by the peculiarities of each

case. As a rule, the life of the child whose breech is delivered will be enfeebled or lost by compression of its funis, or it may be already extinct. Hence in selection of operative measures superior value should be allotted the second child. The head of the second child may possibly be pushed up out of the way for the other to pass. The second head *may* (?) be delivered by forceps while the first remains, but not without difficulty and great danger to both children. The head of the first child may be punctured, or even decapitated, so

FIG. 276.



Labor impeded by hydrocephalus.

as to allow extraction by forceps of the second one, the body of the first (when decapitation has been performed) being, of course, previously removed; its head coming after the other child is born. This last method probably affords the best chance for the second child. Most frequently both are lost. When the lives of both are extinct before delivery there still remains another resort, viz., that of puncturing the second head and delivering it by forceps or cephalotribe past the body of the lower child.

The operation of symphysectomy would seem to be a feasible method of relief in locked twins, but cases have not yet been reported.

In cases of *conjoined twins—double monsters*—when the natural powers are insufficient for delivery, version by the feet, and possibly subsequent mutilation, afford the best means of relief. Most such cases are, however, delivered spontaneously.

HYDROCEPHALUS.

Hydrocephalus is distention of the skull from accumulation of effused serum, and constitutes a dangerous impediment to delivery, leading to rupture of the uterus or dangerous inflammation and sloughing of the mother's soft parts from their prolonged compression during a tedious labor. When slight in degree, labor may, however, terminate spontaneously without danger. In extreme cases the child's head is as large as that of an adult. (See Fig. 276, also Fig. 271, page 519.)

Diagnosis.—Difficult early in labor. Strong pains conjoined with a (known) normal pelvis, but without expected descent of the head, should excite suspicion and induce a careful examination. Owing to unusually large size of fetal head, the child's body is higher up, hence sounds of fetal heart heard level with or even above the umbilicus. When head is arrested above superior strait, pass the whole hand into vagina (under ether, if necessary from pain) and feel the head. Its large size, wide, and perhaps fluctuating fontanelles and sutures are sufficiently characteristic. The head is less convex, and feels more like a flat lid over the pelvic brim than a globular mass. The sutures and fontanelles become tense during a pain. The cranial bones are less resistant to the finger. An enlarged *posterior* fontanelle is very significant. The prominent forehead and superciliary ridges contrast with the comparatively small face of the child. The previous birth of a hydrocephalic infant, and comparatively feeble fetal movements, are corroborative circumstances.

In breech presentations (they occur one out of five in hydrocephalic cases) the diagnosis is more doubtful. Nothing wrong is suspected, usually, until the body is born; then there is delay, an unusual resistance—a sort of elastic,

resilient resistance — on making traction upon the body. The body *may* be well nourished, but frequently is small and emaciated. The uterine tumor is of larger size than usual above the pubes, owing to its containing the distended cranium.

Prognosis.—The chief dangers to the mother are uterine rupture; exhaustion; laceration, contusion etc., of soft parts, with subsequent ulcerations and fistulæ; all preventable, in great measure, by timely assistance of the obstetrician. The child generally dies, either before, during, or shortly after delivery. Exceptions possible.

Treatment.—In head presentations, aspirate, or tap skull with trocar and canula to lessen its size, when this is absolutely required. Cases of moderate enlargement may be delivered spontaneously, but it is better not to risk life of mother by delay for the sake of a child whose survival at best is extremely dubious. After puncture and reduction of size of head, it may be *possible* to extract by forceps, but they are nearly sure to slip off during traction if the head be very large. Then either the cephalotribe or cranioclast may be used; or the child may be turned and delivered by the feet, especial care and gentleness being necessary to avoid rupture of the womb.

In breech presentations, puncture of the after-coming head may be made behind the ear, or through the occiput, or through the orbit, or roof of the mouth; or the spinal cord may be opened and a wire or a metal catheter passed through it to the brain and the fluid thus drawn off.

ENCEPHALOCELE.

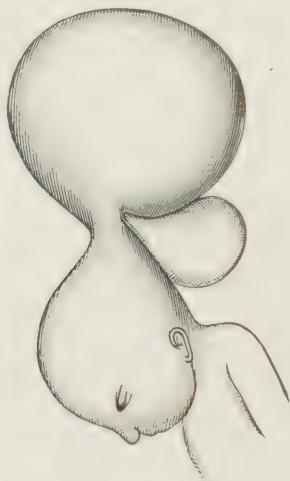
Associated with, though at other times independent of congenital hydrocephalus, may be an accumulation of cephalic fluid outside the cranium underneath the scalp, forming a tumor, insignificant in size, or as large as a foetal head, whose cavity may or may not communicate with that of the cranium. It is attached to the head by a pedicle, and constitutes a so-called encephalocele. (See Fig. 277.) Fortunately, such tumors are more often attached either to the frontal or occipital pole of the foetal head, and hence are less liable to interfere mechanically with delivery

than when placed elsewhere. The bones of the cranium are also usually softer and more yielding. Puncture of the sac and evacuation of its fluid will remedy any mechanical interference with delivery that may arise.

ANENCEPHALUS.

A not uncommon monstrosity in which the brain is deficient or rudimentary; the upper part of the cranium is absent, leaving the base of the skull without bony covering; some-

FIG. 277.



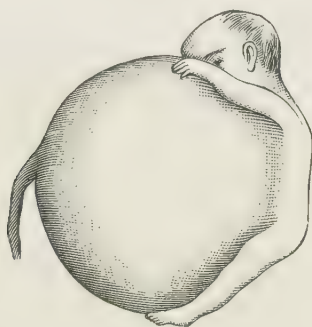
Encephalocele. (From HERGOTT.)

times arrest of development in spinal column and spinal cord. Often associated with polyhydramnios. Shoulders may be very broad and obstruct delivery. Diagnosis sometimes made by finger touching the *sella turcica*, covered by soft tissues in base of skull, which may present at centre of pelvis. Child either born dead or dies soon after birth. In case operative assistance be necessary, perform embryotomy.

ASCITES, TYMPANITES, DISTENTION OF URINARY BLADDER, ETC.

Ascites, tympanites, distention of the urinary bladder, hydrothorax, hydronephrosis and various other pathological enlargements on the part of the child, may occasionally lead to difficult labor and require operative interference. (See Fig. 278.) They are extremely difficult to diagnosticate

FIG. 278.



Distention of urinary bladder of fetus.

before delivery. The diagnosis chiefly rests upon the exclusion of more common causes of mechanical obstruction, and (in the case of gaseous or liquid distention of cavities, etc.) on the *springy, resilient resistance* recognizable when traction is made on the presenting or extruded foetal parts. Liquid or gaseous accumulations are to be relieved by careful puncture, preferably by aspiration, if the child be living. Forceps, version, and exceptionally embryotomy, may afterward be required.

LARGE SIZE OF THE CHILD.

Premature Ossification of the Cranial Bones.—In over-long pregnancies (those of $10\frac{1}{2}$, 11, or 12 lunar months) the child is apt to be far above the usual size and weight. Instead of weighing seven or eight pounds (the average), it may reach

twelve, fifteen, or even more, and though the increase is distributed over the whole body, the degree of cranial enlargement especially may considerably impede delivery, and a certain amount of difficulty may even attend extraction of the shoulders and body. In carefully measuring the cranium of a child weighing thirteen and a half pounds, immediately after birth, I found all of its diameters nearly an inch above the average length. Such infants are usually males. In well-formed and good-sized pelves, delivery may be accomplished by forceps, version, or symphyseotomy. In very extreme cases craniotomy, or, if the child be alive, Casarean section may become a possible necessity. In delivery of the body, traction and manual aid in furthering the normal mechanism of labor will usually suffice.

Premature Ossification of the Cranium.—This is sufficient to interfere with moulding of the head, thus producing dystocia (difficult labor). It is very rare.

Diagnosis by complete closure of the fontanelles and sutures, and unyielding resistance of the bones to pressure of examining finger.

Treatment.—Forceps, if required; possibly perforation of the skull, or abdominal section. In some cases symphyseotomy may be advisable.

CHAPTER XXIX.

TEDIOUS LABOR (DYSTOCIA), POWERLESS LABOR, AND PRECIPITATE LABOR.

TEDIOUS LABOR.

TEDIOUS labor is also called "*lingering*" "*tardy*," "*protracted*," and "*prolonged*" labor. These terms refer to *time*, but the duration of labor varies so widely within the limits of normality, that it alone is not sufficient to indicate the technical and practical meaning of "tedious" deliveries. Certain other phenomena, mentioned below under the head of "*Symptoms*," are necessary, before any case can be set down in this category. Recent authors have almost abandoned the term "*tedious labor*," and include such cases under the caption of "*Dystocia*," meaning *difficult* or obstructed labor.

Causes.—The very numerous conditions liable to produce tedious labor may be broadly comprised in two lists: 1. Conditions impairing the natural *forces* of labor. 2. *Mechanical impediments* to delivery. Both kinds of conditions may, and necessarily often do coexist.

The mechanical impediments refer either to the *mother* or to the *child*. Following the classification of Simpson, we have, therefore, altogether: (1) Abnormal *power*; (2) abnormal *passage*; (3) abnormal *passenger*.

Abnormalities of Power.—The *main* force by which the child is expelled is that of *uterine contraction*. This may be impaired in various ways. In some cases the pains are *weak and inefficient from the beginning*—a condition of things quite different from weak pains *following* long-repeated *strong ones* and produced by uterine exhaustion. Or, again, the pains may have been moderately strong or normal at first, and then lapse into weakness later, but again *without* uterine exhaustion from prolonged effort. The *causes* of this *primary* inefficiency of uterine contractions are overdistention of the womb

from plural pregnancy or polyhydramnios; distention of the bladder or rectum; obliquities and displacements of the uterus; thinning of the uterine walls resulting from frequent and quickly repeated labors, or from degeneration of the uterine tissues; precocious or advanced age; general debility or feebleness of the woman from previous diseases, enervating habits, heat of climate or of season, or the air of a superheated room; exhaustion of the woman from hemorrhage or from lack of sleep or food. Uterine action is sometimes inefficient from uræmia, and when there is morbid adhesion between the fetal membranes and uterine wall. Mental emotions; fear, grief, surprise, anxiety, disappointment, and the presence of offensive persons or things will produce it. These last may depend upon idiosyncrasy or unaccountable personal antipathies. It should be especially noted that the lingering cases now described are characterized by *inefficient pains from the beginning of labor*; hence sometimes called *primary inertia*.

Another and different class of cases is that in which labor pains have been normally strong, or even stronger than normal, and *afterward* become feeble and less frequent, or cease altogether. In these the womb becomes more or less passive from muscular exhaustion on account of overwork; it is *secondary inertia*. The organ simply needs rest. There may or may not be mechanical obstruction to delivery. This passive womb is *soft and pliable*; the different parts of the child may be *easily felt* by abdominal palpation.

A *third* set of cases is that in which the normal intermittent labor pains have grown feeble or ceased altogether, while the womb, instead of being soft and relaxed, is in a condition of *continuous rigidity*; its muscular walls *remain hard*, and closely embrace the child with a *persistent spasmodic grasp*. This condition is spoken of as "*tonic contraction*" and "*uterine tetanus*." The womb feels like a *solid tumor*; the different parts of the child *cannot* be recognized by palpation through its rigid walls. It is usually *caused* by some *mechanical obstruction* and consequent *uterine exhaustion* after prolonged and *unsuccessful strong expulsive pains*. Ergot may produce it. In some (but not in all) of these cases the thinning of the lower uterine segment and thickening of the upper region, separated by the "*retraction ring of Bandl*" (as

previously described in the chapter on "Rupture of the Uterus"), may be discovered by palpation.

The so-called cases of "*tetanoid falciform constriction of the uterus*," supposed to be an irregular, partial, or spasmodic contraction of certain more or less central circular bands of muscular fibres, and resembling the "*hour-glass contraction*" observed during the third stage of labor, is probably nothing more than tetanic constriction of Bandl's ring. It is so exceedingly rare that its occurrence has been denied by some, while others affirm they have clinically demonstrated its existence by feeling the constriction band like a "*metallic ring*" or "*circle of iron*," with the hand in the uterus.

Still another abnormality of power consists in the pains being *excessively painful pains*, usually due to *exalted nervous sensibility* or unusual *susceptibility* to suffering. Some men bear pain better than others; so with women in labor—some tolerate the suffering without much complaint, others are *excessively sensitive*.

In some the extreme pain has been ascribed to rheumatism of the uterine wall, or to parenchymatous metritis following a blow or some other traumatic injury before labor.

Again, either with or without any abnormality of the *uterine contractions*, labor may be impeded by some abnormality in the *contractions of the abdominal walls and diaphragm*—in the straining or "*bearing-down*" efforts, constituting the *secondary forces* of parturition. This may occur in any case where the woman is unable to take in a long breath and hold it long enough to accomplish the act of straining, as in diseases of the lungs, pleura, heart, or abdomen, or any other condition producing dyspnoea. Bronchocele, obesity, ascites, deformities of chest and spine sometimes act in this way. Feeble abdominal contractions also arise from the *woman herself* being enfeebled by previous disease, or exhausted from previous prolonged straining efforts; or again, excessive suffering may cause the woman to voluntarily refrain from bearing down.

Abnormalities of the Passage.—The mechanical impediments to delivery referable to faults in the parturient canal from which tedious labor may result are numerous, embracing, of course, every kind and degree of obstruction, such as smallness, deformity, and abnormal growths of the pelvis; and resistance, rigidity, deformity, and abnormal growths of the soft parts, etc.

Abnormalities of the Passenger.—The mechanical impediments on the part of the child are its over-large size, malpresentation, disturbed mechanism, pathological growths, locked twins, etc.

Prognosis and Danger of Tedious Labor.—The first stage of labor, before rupture of the membranes, may be greatly prolonged, even for several days, without any *necessarily* serious consequences to either mother or child. Exceptions, however, occur. The continuance of anxiety, suffering, and physical effort, with consequent loss of sleep and inability to digest and assimilate food, if long protracted, *always* entails a *liability* to nervous exhaustion that cannot be regarded without apprehension in any case. Before rupture the waters act as a cushion between womb and child, thus protecting both from injurious pressure. Pressure upon the funis and obstruction to the placental circulation, such as may occur when the womb is long contracted round, and in close contact with the child, are also obviated.

During the second stage, when the womb *does* contract powerfully, and in close contact with the infant; when the placental circulation, therefore, *is*, or may be, partially interfered with; and when the soft parts of the mother, both the uterus and other parts below, are necessarily subjected to great pressure, the results of prolongation of the labor become far more serious. Swelling, edema, inflammation, with subsequent sloughing and fistulae, may occur; the child may die from continued compression of its skull, cord, or placenta; and general symptoms of exhaustion and collapse take place, from which the woman, if not promptly delivered, may die on the spot, or succumb afterward from post-partum hemorrhage, puerperal inflammation, septicæmia, etc.

Every case, therefore, of actual or impending tedious labor should excite apprehension for the woman's safety, increasing in degree according to the extent to which the symptoms have progressed, and the estimated difficulty of prompt delivery. With timely assistance, safety may often be assured, while delay may render recovery impossible.

Symptoms.—These, be it noted once for all, usually begin moderately, but increase in varying degrees of rapidity with delay.

In cases of *primary uterine inertia* the pains (as we have

said before) are usually inefficient *from the beginning*. These cases, unless *very* much prolonged, are *not* accompanied with *serious general* symptoms. *As a rule*, there is no great frequency and feebleness of pulse, no rapid respiration, no heat of skin, no fever, no general exhaustion; in fact, there has been no violent physical effort—no strong pains—to *produce* fatigue and expenditure of nervous force. Loss of sleep, lack of food, and anxiety, etc., may, however, *eventually* produce it in *very* protracted cases.

In cases of *secondary uterine inertia* the pains have commonly begun normally, and normally increased in strength, frequency, and duration, or they may have exceeded the normal limit in these respects. Both womb and woman have usually labored hard and (more or less) long, but the pains, though strong, have still been *relatively* inefficient—*i. e.*, they have been insufficient to overcome the existing resistance and accomplish delivery. There now appear symptoms indicating *exhaustion of the womb*, viz., the pains become *irregular* in their recurrence, *shorter* in duration, *more feeble*, and *less frequent*. Eventually they may stop altogether. The uterus is worn out by prolonged effort. Its relaxation becomes so complete that the different parts of the child may be felt by abdominal palpation through the now inert uterine wall.

A *second* set of symptoms indicates *exhaustion of the woman*, viz., increased feebleness and frequency of pulse; coated tongue, becoming later dry and discolored; rapid breathing; vomiting; dejected countenance; restlessness, despondency, irritable temper, peevishness, wilfulness, drifting on later (if not relieved) into delirium and despair.

A *third* set of symptoms, usually most pronounced when labor has advanced to the second stage, and due to *commencing inflammation in the soft parts* from prolonged pressure against them of the child, occurs, viz.: *swelling, tenderness, pain, heat, lack of moisture* in the vagina, uterus, vulva, etc., and demonstrated by digital examination, together with *redness, lividity*, or other abnormal discoloration demonstrated by inspection.

It should be especially noted that these three sets of symptoms may exist in *every shade of degree*; they may be only slight or very pronounced. No case should be allowed to progress from the slighter and earlier symptoms of exhaus-

tion to the later and more grave ones without prompt measures of assistance and relief.

In the *worst* cases, instead of the womb remaining soft and inert, and while intermittent pains may have *entirely ceased*, the uterus is *hard* and spasmodically *contracted round the child*, and *remains so continuously* (so-called "uterine tetanus"). Here the symptoms indicating *exhaustion of the woman* are much more pronounced than when the uterus is in a state of relaxation and inertia. Furthermore, in the rigid contracting condition the womb is *tender to the touch*; in the inertia cases it is *not* usually so. Some mechanical obstruction, either fetal or maternal, is commonly present, as indicated by lack of progress in descent, immobility and swelling of the presenting part, or by actual demonstration of existing impediment.

Diagnosis.—The combination of symptoms just stated, even in their early and slighter manifestations, especially when coupled with prolonged duration and lack of progress in the labor, and evident causes of mechanical hindrance to delivery, can leave no possible room for doubt. Other conditions leading to cessation of labor pains, frequent and feeble pulse, collapse, such as, *e. g.*, rupture of the womb and hemorrhage, have a different history, and the symptoms are sudden instead of gradual in their approach.

Treatment.—The main element of treatment is to treat the case *early*, before the symptoms have progressed beyond recovery. The indications are, in the beginning, to correct or remove existing causes of uterine inertia and existing mechanical impediments to delivery. When manual or instrumental delivery is required, the operation should be begun, if practicable, before, or at least as soon as the symptoms of tedious labor *begin*.

When the pains have been inefficient and feeble from the beginning (*primary* uterine inertia), the causes that lead to it must be removed.

In every case ascertain that the bladder and rectum are empty. If they are not, a catheter and purgative enemata must be used.

Excessive distention of the womb from dropsy of the amnion requires evacuation of the fluid by rupture of the membranes; distention from twins, delivery by forceps or version.

The effect of violent mental emotion can scarcely be ameliorated else than by moral persuasion, quiet rest, and perhaps a composing dose of valerian (elix. valerinat. ammon., gtt. xx), or one drachm of the fld. extr. of valerian. Any offensive person or thing should be removed.

Uterine feebleness from sleeplessness due to a prolonged first stage of labor requires a full dose of morphia (gr. $\frac{1}{4}$), or of chloral hydrate (gr. xx). The same remedies may be used with good results in cases where the pains become feeble from the woman having endured excessive suffering—the pains having been extremely “*painful pains*.” The *cause* of the extreme pain should be found and, if possible, removed, before the anodyne is taken. The suffering may be mitigated by a little ether inhaled just as the labor pains begin.

Lateral obliquities of the uterus may be corrected by a finger hooked into the os, while pressure is made in the right direction upon the fundus. The woman should lie on the side opposite that to which the fundus is directed, so that the latter falls straight by its own weight.

Unusual resistance of “*tough membranes*,” or adhesion of the decidua to the uterine wall must be remedied, respectively, by rupture of the sac, or by breaking up the adhesions with a finger.

A feeble, debilitated woman must have food (milk is best), and a moderate quantity of wine or alcoholic stimulant, given cautiously in small quantities at short intervals.

When the *causes* have been removed, the lazy actions of the uterus may be stimulated into more vigorous contractions by a warm vaginal douche, introducing a bougie into the uterus, dilating the cervix with Barnes water-bags, and by the internal administration of sulphate of quinine in doses of 10 or 15 grains. The use of ergot is extremely questionable. It should never be given to primiparæ, nor in cases of mechanical obstruction. If given at all, it should only be in small doses of 5 or 10 drops of the fluid extract every half hour, and stopped as soon as uterine contractions have been reinforced. In cases where the inefficient pains have continued long enough to produce exhaustion of the woman, or *commencing* exhaustion, delivery should be assisted by forceps or by whatever operative measures the stage of labor and nature of the case will admit.

In cases of *secondary* uterine inertia, in which the womb and woman are exhausted from fruitless prolonged effort, the best treatment is to restore the flagging powers by *sound sleep* produced by *full doses of opium, morphia, or chloral*. By sleep the nervous energies are restored, the pains are renewed, and *now* delivery should be hastened by forceps or other operative measures the existing obstruction may call for. If delivery by an operation should be accomplished while the uterus *remained soft, pliable, and inert*, post-partum hemorrhage would be almost sure to follow.

In cases of "*tonic contraction*," in which the womb retracts down upon its contents with continued persistent rigidity, and the woman is greatly exhausted, *delivery at once*, without any delay, is the only proper course to pursue, the method of proceeding depending, of course, upon the kind and degree of existing obstruction.

POWERLESS LABOR.

Powerless labor practically means nothing more or less than the last stage of tedious labor, previously described. The powers of the woman and of her uterus are completely exhausted. Such cases should never be permitted to occur; and scarcely ever would if "tedious" cases were promptly delivered before they become too far advanced, as above recommended. (See "Tedious Labor," pages 547 and 548.)

PRECIPITATE LABOR.

Precipitate labor is one in which the child is delivered with unusual rapidity. It is of comparatively infrequent occurrence. The infant may be expelled unexpectedly, while the woman is standing or walking, and as sometimes unpleasantly happens, in public places; or while she is at stool. The child may be injured by falling from the mother—such cases sometimes leading to undeserved suspicions of infanticide. The umbilical cord may be ruptured in its continuity, or torn out at its junction with the navel, but the bloodvessels usually contract and prevent hemorrhage. The child may be born in its unbroken membranes, and drowned in the liquor amnii. Numerous alleged dangers to the mother may result from precipitate

labor; but their occurrence is, on the whole, exceptional. These are inertia and post-partum hemorrhage from sudden emptying of the womb; inversion of the uterus; syncope from abrupt reduction of abdominal distention; rupture of the uterus, laceration of its cervix, and of the perineum or vagina; procidentia of the womb.

Causes.—Unusually large size of the pelvis (pelvis æqualiter justo-major). Unusual laxity and diminished resistance of the soft parts, as in cases of uncured extensive laceration of cervix uteri, the result of a previous labor. Excessive force and frequency of the pains, and of reflex contraction of the abdominal walls and diaphragm, generally due to peculiar temperament or nervous excitability of the woman.

Symptoms.—The pains come on with little or no warning, and are bearing down in character from the beginning, quickly succeeding each other, and rapidly progressing to very great intensity. In a large pelvis, or when the child is very small, labor may be terminated in a few minutes, without any *necessarily* over-violent pains. Violent pains and a large pelvis may, however, coexist. The child may be born during sleep, the woman dreaming she had colic. Intensity of suffering, on the other hand, may produce transient mania.

Treatment.—Treatment should be preventive in women who have previously had precipitate labor. It is liable to recur—certainly so when the pelvis is over-large. The woman should keep her room during the last week of pregnancy and go to bed on the first indication of labor pains, a competent nurse having been previously provided.

During labor, anaesthesia constitutes the readiest means of lessening undue violence of the pains. Opium internally; morphia given hypodermically, or by rectal suppositories, when there is time for them to act. Tepid enemata, to wash out the bowel, and an abdominal bandage have a soothing influence to some extent. The woman must avoid bearing down, as far as possible, by crying out, instead of holding in her breath during a pain; and everything likely to increase uterine contraction must be avoided. Procidentia may require a T-bandage over the vulva, an aperture being made in it through which the child may be born.

CHAPTER XXX.

DIFFICULT LABOR—DYSTOCIA—FROM ABNORMALITIES OF THE MATERNAL ORGANS.

DEFORMITIES of the *pelvis* have already been considered (Chapter XXII., page 442). The present chapter refers to abnormal conditions of the *soft parts* producing mechanical obstruction in the parturient canal.

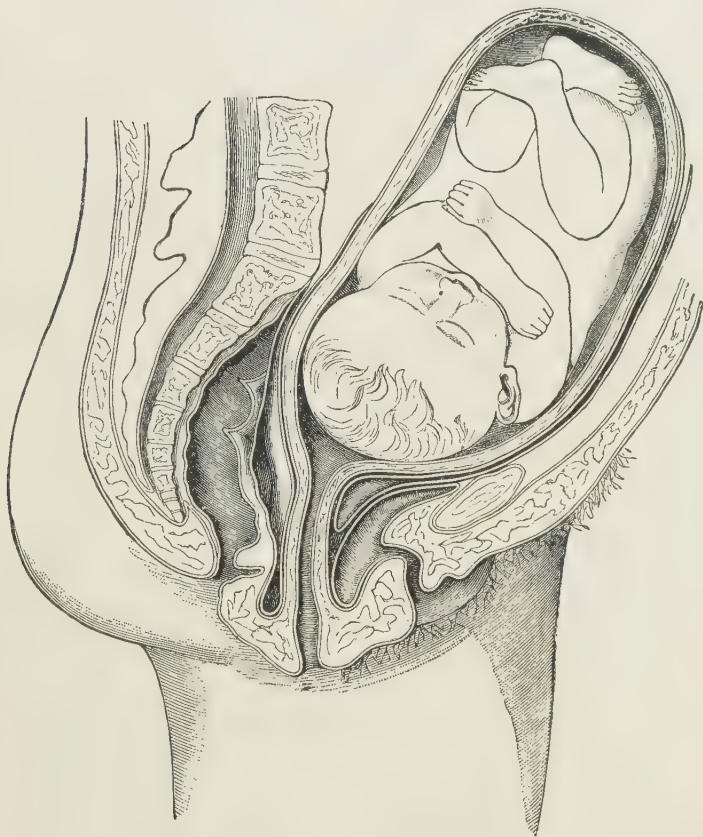
In quite *normal* labors there are *always* two barriers by which delivery of the child is *more or less* impeded; these are the *os uteri* and the *os vaginae*. The degree to which these interfere with delivery largely depends upon the ease with which the two openings dilate. Hence a *rigid os and cervix uteri*, and a *rigid perineum*, which refuse to dilate before the pressure of the presenting part, may thus obstruct delivery.

Rigidity of Os Uteri.—Rigidity of the *os uteri* is either *spasmodic* or *organic*. *Spasmodic* rigidity occurs in highly nervous and emotional primiparae most frequently; or may be due to premature rupture of the membranes; or to prematurity of the labor, in which last the tissues of the *os* and *cervix* have not yet undergone the usual softening by which their dilatability is increased; advanced age in primiparae presents the same condition; the parts are less supple and dilate more slowly than in younger women. Again, in conditions where the presenting part of the child cannot descend and fill up the *os uteri* (as in narrow pelvis or cross presentation) dilatation will be slow. In *most* cases of *spasmodic* rigidity associated with an *unruptured* bag of waters, labor is delayed not so much on account of the rigidity itself, as because of inefficient pains; that is to say, if pains continue good and strong, almost any case of *spasmodic* rigidity will yield before them.

Treatment of Spasmodic Rigidity.—When the membranes are intact, time and patience usually remedy the difficulty;

but in these cases, as in others where the membranes *have* ruptured, dilatation is greatly expedited by full doses of chloral hydrate, grs. xv, repeated every twenty minutes till

FIG. 279.



Elongated cervix with procidentia during labor. (BARNES.)

two or three doses have been taken ; or instead of this, a full dose of morphia sulphate (gr. $\frac{1}{4}$ to $\frac{1}{2}$) may be injected hypodermatically ; or a 10 per cent. solution of cocaine may be

applied to the cervix uteri on a pledget of cotton. Conjoined with the anodyne, a warm bath or hip bath of fifteen or twenty minutes' duration, or a douche of warm (not hot) water thrown against the cervix for a few minutes, contribute to relax the rigidity. Artificial dilatation with the fingers, or with Barnes water-bags, is of service in cases where the natural bag of waters has been prematurely ruptured and the cervix is stretched tightly around the head. In cases where the membranes remain *unbroken* artificial dilatation is probably useless, or worse.

Organic rigidity of the os and cervix uteri occurs from the development in the parts of fibrous connective tissue, the result of chronic inflammation, or the cervix is indurated from cicatricial, so-called "*scar*" tissue following former lacerations, and this (still more rarely) is liable to be accompanied with *hypertrophic elongation* of the cervix and prolapsus.

Treatment.—Milder grades of *organic* rigidity may yield to the remedies just cited for *spasmodic* cases. Should these fail, and the conditions not admit of delay, the rim of the external os may be *incised* with blunt-pointed scissors or a probe-pointed bistoury, so as to make three or four notches, about a quarter of an inch deep, at different points. Barnes dilators may be used *after* the incisions as well as *before* them. Absolute antiseptic cleanliness must, of course, be observed.

In cases of hypertrophic elongation of the cervix, with prolapsus or procidentia (see Fig. 279), incisions and mechanical dilatation will be necessary. Forceps may be used when the parts are sufficiently open, and delay becomes inadvisable from impending symptoms of exhaustion, etc. Cesarean section has been advised, and might be justifiable under very urgent circumstances. When gestation, coexisting with elongated cervix, is made out soon enough, amputation of the hypertrophied neck may be done at the third month. It does not *necessarily* disturb pregnancy.

Rigidity of the Perineum.—The structures at the vaginal outlet, like those of the os uteri, must dilate to the extent of three or four inches in diameter before the head can pass. The resistance of a rigid perineum is more common in primiparae, especially in those no longer young. Actual rigidity (except in cases with *organic* changes due to cicatricial tissue

following the healing of former lacerations) is, however, more apparent than real. It is the *power*, not the *passage*—the *pains*, not the *perineum*—that are really at fault. It is an every-day experience to see the head come down to the perineum and stop there, perhaps for several hours. The pains fall off and become weaker and less frequent. There may be no mechanical obstacle to delivery beside resistance of the soft parts at the outlet. The usual reason of this delay is that the womb and woman have been so far worn out by the preceding parts of the labor that the little additional effort necessary to force the child through the vaginal outlet is beyond their power. To use a figurative expression, the resistance of the perineum is “the last straw that breaks the camel’s back.”

Treatment.—When the head is thus arrested at the inferior strait, and there is no other mechanical obstacle to delivery but resistance of the perineum, the best method of treatment in the larger number of cases is delivery by forceps. While true that in a certain number of cases delivery would, in due time, spontaneously occur after some hours’ further delay, provided the uterine inertia and general exhaustion were not excessive and there existed no absolute mechanical obstacle to delivery, experience has nevertheless, amply proved that the required additional delay is *not to be depended on*, while delivery by forceps may be safely and often quite easily performed. The old maxim, “Meddlesome midwifery is bad,” cannot be applied in these cases. Though delivery *might* in time spontaneously occur, the chances of final and rapid recovery, after labor, are far less than when forceps are applied *without* delay.

In place of forceps—as under circumstances where they cannot be obtained—delivery may be expedited by *manual pressure* upon the uterus (and thus upon the breech of the child) through the abdominal wall.

Manual pressure is simply a substitute for uterine contraction. It may be used to reinforce feeble pains or replace absent ones; and must imitate them, especially as regards intermittence, duration, and force, as nearly as possible. Complete expulsion of the child, by pressure properly applied, has even been accomplished when the pains were entirely absent. It is applied thus: The patient lying on her back, spread the

palms of the hands out over the sides and fundus of the womb, and when a pain begins make firm pressure, while it lasts, *downward and backward*, in a line with the axis of the plane of the superior strait. Lessen, and then stop pressing as the pain goes off. If there be *no* pains, imitate them as nearly as possible. If the woman lie upon her side, one hand only can be used (the left, if she lie on her left side; the right, if on the right) to make pressure on the fundus, while the other guards the progress of the presenting part *per vaginam*.

Manual pressure must *not be employed*, of course, when the uterus is very tender on pressure, nor when it is spasmodically contracted round the child, nor when there is any mechanical impediment to delivery.

Sulphate of quinia, grs. xv, may be given to reinforce the pains; food and stimulants to relieve general exhaustion; and ergot to secure firm retraction of the uterus when labor is over.

Organic rigidity of the perineum (cicatricial induration following healing of former lacerations) may require digital dilation, and, very rarely, incision of the resisting tissues (episiotomy) as recommended to prevent rupture. (See page 260.)

Beside resistance of *os uteri* and *perineum*, which are quite common, the more rare forms of obstruction by the soft parts may next be considered. These are:

Swelling and Œdema of the Anterior Lip of the Womb.—(Œdema is caused by its getting pinched between the head and pubic symphysis. It must be pushed up with the finger-ends, and held there for several successive pains, until the head slip by it. If *much* swollen and appearing at the vulva, as may occasionally occur, pushing it up is impracticable. Deliver the child by forceps, or by whatever method may be necessary, without delay.

Imperforate Hymen.—An *absolutely* imperforate hymen would prevent impregnation; an *apparently* imperforate one may contain a small, undiscovered opening, large enough to admit entrance of spermatozooids, and may thus afterward constitute an obstruction to delivery. The organ may be perforated with a visible round opening (*hymen annularis*) or with several small apertures (*hymen cribriformis*).

Diagnosis.—By impossibility of introducing finger, and by

subsequent inspection of parts. Previous history of partial retention of menses.

Treatment.—Incision may very rarely be required.

Atresia of the Vulva.—Atresia may be partial or complete, resulting from inflammatory adhesion; healing of ulcerated surfaces following traumatic injury; or inflammation attending exanthemata, former labors, etc. It may be congenital.

Diagnosis.—By inspection.

Treatment.—Obstruction usually overcome by spontaneous dilatation during labor. Artificial dilatation by tents, or Barnes dilators, or careful incision along the median line, while labia are stretched laterally, may be necessary.

Œdema of Vulva.—When excessive, it may require numerous small punctures for its relief, always preceded and followed by antiseptic cleanliness.

Atresia of Vaginal Canal. Atresia may be *congenital* or *acquired*; *partial* or *complete*. Non-congenital cases are due to inflammatory adhesions following injury of former deliveries, pessaries, and other traumatic causes; or to inflammation of exanthemata and other constitutional diseases. Considerable surfaces may become adherent, or constricting cicatricial bands only exist.

Diagnosis.—By digital examination, or ocular inspection through speculum.

Treatment.—Artificial dilatation by elastic water-bags, tents, etc. Dissection through obstructing tissue with finger, or finger-nail, during labor pains, gradually executed with care not to penetrate vesico- or recto-vaginal walls. Shallow vertical incisions—longitudinal scarifications—for cicatricial bands; and careful vertical incision of central septum of adherence in bilateral union may be required. Finally, forceps delivery, to prevent prolonged compression of parts by fetal head.

Vaginismus (Spasmodic Contraction of the Vaginal Orifice or Canal).—Vaginismus is associated with spasm of the levator ani muscle very rarely; it may interfere with labor and require forceps or other artificial aid.

Cystocele (Prolapse of Vesico-vaginal Wall).—Cystocele may be due to, or associated with, retention of urine and vesical distention. (See Fig. 280, page 558). The prolapsed wall presents a tense, fluctuating tumor, more or less occluding

the vagina; it may be forced down by advancing head, or even ruptured.

Symptoms and Diagnosis.—Known existence of cystocele before or during pregnancy. History of urinary retention. During labor: intense pain; vesical tenesmus and dysuria.

FIG. 280.



Cystocele obstructing labor.

May be mistaken for bag of waters: diagnosticate by feeling presenting part above and *behind* bladder tumor, and by reduction in size of tumor by catheterism. Diagnosis from hydrocephalic head by same means, and by recognition of enlarged sutures, fontanelles, etc., of cranium.

Treatment.—Catheterism, which is difficult, and *may* be impossible, requiring puncture or aspiration through vesico-vaginal septum. Push back or hold up the prolapsed wall during pains, till the head slip by it.

Rectocele (Prolapse of Recto-vaginal Wall).—Rectocele is produced much in the same manner, by distention of rectum by fecal contents, and pushing down of projecting recto-vaginal pouch by advancing fœtus.

Diagnosis.—By putty-like consistence of tumor, and indentation of its contents by digital pressure through recto-vaginal wall, or examination *per anum*.

Treatment.—Remove fecal accumulation by emollient enemata, or scoop out hard masses with spoon-handle or finger. Push back prolapsed wall while head passes by it.

Impacted Feces.—Without rectocele, this may be sufficient to obstruct delivery.

Treatment same as above described. Prophylaxis by laxatives during pregnancy.

Vesical Calculus (Stone in the Bladder).—When of considerable size, calculi may very rarely obstruct labor, and lead to cystocele or vesico-vaginal fistula from compression of vesico-vaginal wall between calculus and fœtal head.

Diagnosis from Exstosis, etc.—By mobility of calculus, felt *per vaginam*, between the pains, as a hard tumor behind and sometimes above the pubes, and by sounding bladder.

Treatment.—Lift the stone above the pelvic brim by digital palpation *per vaginam*. If this be impracticable, crush it, or extract through rapidly dilated urethra. If these be too tedious, perform vaginal lithotomy through neck of bladder. Vesical calculus recognized during pregnancy should be removed before labor, some time after the seventh month, so that if labor be produced by the operation, the child may be viable.

Occlusion of External Os Uteri.—The lips of the os are either completely closed from former adhesive inflammation, or an observed or unobserved opening may exist, of so small a size as to constitute *practical* occlusion, so far as delivery is concerned. The adhesions may have followed traumatism of the parts from instruments used in producing abortion, or cauterization, lacerations, ulcers, etc.

Symptoms and Diagnosis.—Absence of the os on palpation

and even on inspection by speculum. A circular dimple may be recognized where the opening ought to be. The cervix and internal os are widely distended, perhaps by the advancing head, their tissues being so thin as to necessitate care not to mistake them for the fetal membranes; the recognition of their continuity with the vaginal wall would prevent the mistake. In uterine lateral obliquities and exaggerated ante- or retroversion, an existing os uteri may be tilted out of reach of the finger in ordinary vaginal examination, the os only being discovered by passing the whole hand through the vulva, and thoroughly exploring every part of the vaginal roof.

When occlusion really exists there is danger of rupture of the uterus, as well as of "tedious" labor, if relief be not afforded.

Treatment.—Make an opening where the os ought to be. Having found the circular dimple above stated, it may, if the obstructing septum be thin, be penetrated by pressure of the finger or finger-nail during the pains. Under other circumstances a small crucial incision must be made, preferably with a guarded bistoury, over the same spot or when no dimple can be discovered, over the most dependent point of the distended cervix. Tents and elastic bags may be necessary to complete dilatation if it fail to take place spontaneously. In a few cases, where no trace of the os could be discovered, Cæsarean section has been successfully performed.

Atresia of Uterine Cervix.—Atresia within the external os requires either vertical shallow incisions or gradual mechanical dilatation by laminaria tents and water-bag dilators.

Cancer of the Cervix Uteri.—When only involving the lower portion of the cervical canal, the diseased tissues will often yield enough to admit delivery. When extending higher up, the cancerous growth, by its size and want of elasticity, either prevents passage of child or ruptures with severe hemorrhage.

Prognosis.—Of course, most grave.

Treatment.—Incision of cervix with application of perchloride of iron or iodoform gauze to stop bleeding. Perforation may be afterward necessary, if circumstances demand immediate delivery. Another plan, certainly preferable so far as the child is concerned, and, in bad cases, not adverse to the mother's interest, is to perform Cæsarean section as soon as

labor begins. Masses of the cancerous growth may sometimes be broken away with the hand, making a sufficient opening to admit version or forceps.

FIG. 281.



Polypus obstructing labor.

Cystic, Fibrous, and Cancerous Growths Developed in Vaginal Walls.—These growths may, very rarely, lead to sufficient obstruction to require operative assistance before delivery can take place. If small and removable, the growth should be removed. If not, and the tumor is hard and unyielding, craniotomy or Cæsarean section become last resorts.

Polypi of the Uterus.—Pediculated fibrous tumors hanging

in the parturient canal may be of sufficient size to obstruct labor. (See Fig. 281, page 563.)

Diagnosis.—By their mobility—if not impacted—insensibility, pediculation, etc. Small ones might, without care, be mistaken for swollen scrotum of breech presentation.

Treatment.—Push the tumor up, out of the way, above superior strait, and retain it there till head take precedence in descent. When the pedicle is easily reached, remove the growth by *écraseur* or scissors. Some break off during labor and come away of themselves. Some are sufficiently compressible as not to prevent delivery.

Fibroid Tumors of the Uterus.—These tumors are not pediculated, whether subserous, submucous, or interstitial, and may or may not obstruct delivery, according to their size and position. If high up above the superior strait, they produce no obstruction, but may render pains inefficient from asymmetrical uterine contraction, and predispose to ante- and *post-partum hemorrhage*, as well as to abnormal presentation and position of the child. Situated below the brim, in the lower segment of the womb, they necessarily obstruct labor, and may be large enough nearly to fill the pelvic cavity.

Diagnosis.—By history of the tumor, its slow growth, and attendant symptoms before pregnancy, and by its firmness, want of fluctuation, etc.

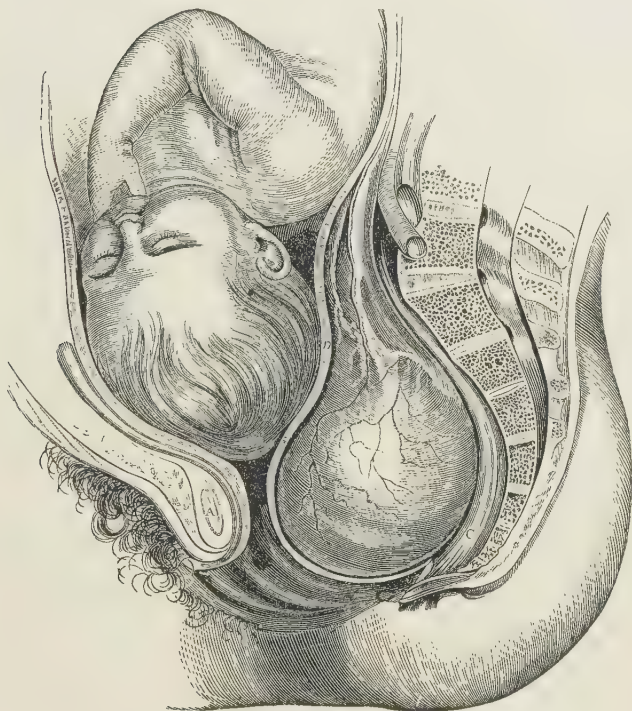
Treatment.—In all cases extra precaution against occurrence of *post-partum hemorrhage*. Applications of styptic iron solutions generally necessary to arrest it. Tumors *below* the brim, even in apparently very unpromising cases, may be pushed up *above* it by persistent pressure with the hand or closed fist, the patient being anesthetized. The knee-elbow position may facilitate success. Surgical interference, enucleation of the tumor, or its removal with *écraseur* when the base is not too large, may be advisable. The only other remedies in bad cases are Cæsarean section and craniotomy. In a lesser degree of obstruction, forceps or version may suffice.

Ovarian Tumors.—These tumors, whether solid or cystic, occupying the pelvic cavity usually between vagina and rectum, may obstruct delivery. (See Fig. 282.)

The *degree* of obstruction depends upon the size, hardness, and position of the tumor, and upon its mobility. Apart from

obstruction, there is danger that the tumor may burst during labor into the peritoneum and produce fatal peritonitis or the pedicle may get twisted and break off. *Very* large ovarian tumors are less dangerous than medium-sized ones, because they are usually discovered before labor, and further, because they are too large to get below the pelvic brim.

FIG. 282.



Ovarian tumor in pelvic cavity obstructing labor.

Diagnosis.—By the position of the tumor; by its fluctuation and consistency. *Fibroid* tumor of the ovary may, however, be so hard as to resemble bony growths of the pelvis; even cystic ones may be so tense as to require puncture with

trocár or aspirator before their nature can be positively ascertained.

Treatment.—Attempt to push tumor above the pelvic brim out of the way. *Persistent* pressure, under anaesthesia, the woman being in a knee-chest position, may unexpectedly succeed. It may, however, fail because tumor is adherent, or of large size, or held down by the presenting part of the child. Then puncture cyst through vaginal wall with trocár and canula, and retain until fluid be evacuated, and if fluid be too thick to flow readily, make digital pressure upon the tumor *per vaginam*. When no trocár is obtainable, make a small incision in the tumor, and after emptying it, stitch up the wound. Should puncture fail to remedy the difficulty, from the tumor being solid, the child must be delivered by whatever *obstetric operation* the space will allow, or instead of this, the tumor itself must be removed by a *surgical operation*—vaginal ovariectomy. Most cases are relieved by puncture of the cyst.

The diagnosis of ovarian tumor having been made *during pregnancy* (i. e., *before labor begins*), it should be removed by abdominal section, as in other cases. The operation does not interrupt the pregnancy, if care be taken to handle the uterus as little as possible.

Hernia of Pregnant Uterus.—The varieties of hernia of the *non-gravid* uterus, named in the order of frequency, are *umbilical*, *ventral*, *femoral*, *inguinal*, through the *foramen ovale*, and through the great *sacro-sciatic foramen*. All forms are rare; and for the uterus while thus dislocated to become *pregnant*, still more rare. Pregnancy has never been observed in uterine hernia through the foramen ovale or great sacro-sciatic foramen. *Inguinal*, *umbilical*, and *femoral* uterine hernias have been observed with pregnancy. The *inguinal* and *femoral* cases always end in abortion or premature labor—the sac of an *umbilical* hernia may contain a uterus far advanced in pregnancy.

Diagnosis.—By absence of uterus from its normal situation, by shape and consistency of tumor, and evidences of its containing a fetus. In inguinal and femoral cases the canal of the vagina is drawn on one side toward the hernia.

Treatment.—Replace womb and apply truss. If growth of pregnancy is already too great for this, induce abortion or de-

livery. Growth may be so large as to require division of hernial ring to permit delivery. If this fail, hysterotomy.

Ventral uterine hernia with pregnancy occurs more frequently; is due to separation of recti muscles, or of dilatation of large cicatrix after laparotomy. Many of these are not *real* hernia—the sac being contained within the fasciæ—but ordinary “pendulous belly.” If the woman, while on her back, attempt to raise the upper part of her body, the pregnant womb will protrude as a globular tumor in the linea alba.

Treatment.—An abdominal bandage. These *ventral* cases go to “term;” delivery is not generally interfered with.

CHAPTER XXXI.

PROLAPSE OF FUNIS—SHORT OR COILED FUNIS.

PROLAPSE OF FUNIS.

A loop of the umbilical cord hangs down alongside of, or below the presenting part of the child. *Before* rupture of the membranes it is called "*presentation*" of the funis; *after* rupture, when the loop falls down into the vagina, "*prolapse.*" (See Fig. 283.)

Causes.—Conditions in which the presenting part of the child does not completely fill or block up the ring of the os uteri and pelvic brim, viz., pelvic contraction or deformity; transverse, footling, knee, breech, and face presentations.

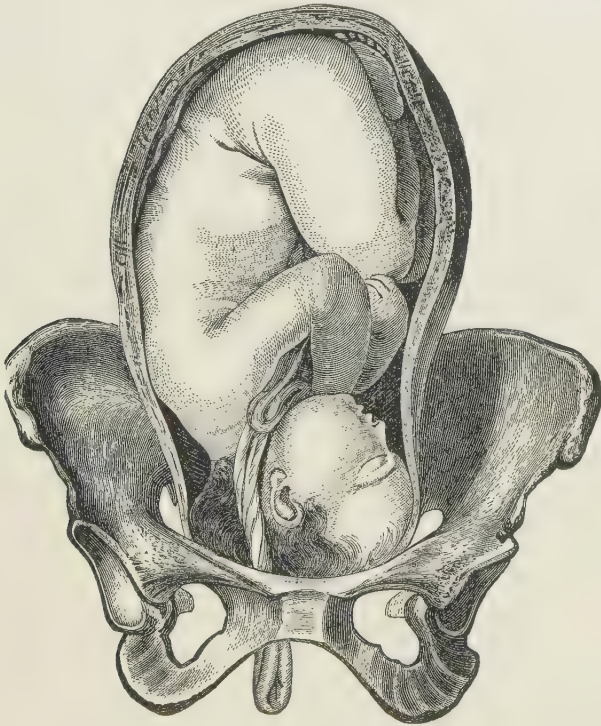
It may occur in ordinary head presentations, as well as under the circumstances just stated, from unusual length of the cord; insertion of placenta near the os uteri; excess of liquor amnii, and gush of amniotic fluid when membranes rupture at the height of a labor pain; and in multiple pregnancy. Head presentation complicated with that of a hand or foot, or with both, especially favors prolapse of cord. From the far greater *relative* number of head presentations there are more cases of prolapsed funis associated with *them* than with presentations of other parts. But in a given *equal* number of each presentation, prolapse of the cord will be found least frequently with head cases, for the reason before stated. Thus Scanzoni's figures are:

Funis presents once in 304 head cases.	
“ “ “	32 face cases.
“ “ “	21 pelvic cases.
“ “ “	12 transverse cases.

Diagnosis.—Diagnosis may be attended with *some* difficulty before membranes rupture, the finger having to feel the cord

through them or through the thinned uterine wall. It feels a soft, compressible, and movable body, in which pulsations, synchronous with the foetal heart, may be recognized. Pressure of cord during a pain may temporarily interrupt pulsations. Pulsations in vaginal or uterine wall are synchronous with *mother's*

FIG. 283.



Prolapse of the cord by the side of the head.

pulse. Confounding fingers or toes of child with funis is avoided by remembering their harder consistency, number, and by absence of recognizable pulsations in them. In cases of uterine rupture a prolapsed coil of small intestine has been mistaken for funis. The attached mesentery, and want of

pulsation in the intestine, are sufficiently diagnostic with ordinary care. When the membranes have ruptured, or the presenting cord has prolapsed into the vagina, there can scarcely be any mistake. Umbilical pulsation of course shows child to be alive, but the pulsation may cease some time before the infant dies; hence auscultate for heart-sounds before death is assumed to have occurred.

Prognosis.—Not unfavorable to the mother, except in so far as may result from emotional disturbance and subsequent breast troubles from child being born dead.

FIG. 284.



Postural treatment of prolapse of the cord.

As regards the child, it is a most serious complication. About 50 per cent. die, owing to compression of funis during delivery. The dangers are less in proportion to the greater length of time that the membranes are *unruptured*, and when the presentation and other conditions are favorable to rapid delivery *after* their rupture. Hence breech presentations which admit of speedy extraction are comparatively favorable. The breech, moreover, is softer and smaller than the head; hence there is less fear of fatal pressure on funis. Transverse cases do not necessarily involve pressure of the cord, and are less dangerous than head presentations *in this*

respect. A large pelvis is favorable. Unfavorable conditions are *primiparity* (owing to length of labor from resistance of soft parts), *contracted pelvis*, *low placental insertion*, and *early rupture of membranes*.

Treatment.—Preserve the membranes from rupture as long as possible. The cord is safer from pressure, when bag of waters is intact, than it can be made by any operative treatment after membranes rupture. One exception is noted below.

Postural Treatment.—Before membranes rupture place the woman upon her side—upon the side opposite that upon which the cord lies—and elevate the pelvis upon pillows, while the head and chest rest low. The cord may thus gravitate toward fundus uteri during early part of labor. The knee-chest or knee-elbow positions are more effective, but difficult to maintain for any considerable time. (Fig. 284.) They should be resorted to at intervals during early stage, the woman afterward resuming her lateral position as above stated. Later on, when the os is sufficiently dilated for the head to pass, the woman may be placed, temporarily, in a decided knee-elbow posture, when, if the cord slip back, the membranes are to be ruptured, and manual pressure applied externally to produce engagement of the head, which last fills the opening, and prevents re prolapse, the woman subsequently resuming and maintaining her latero-prone position.

Should posture alone not suffice to cause the cord to slip back, let the membranes remain intact.

When finally they rupture, artificial *reposition* of the cord must be attempted. There are several methods of operating, all of them being more likely to succeed when the woman is placed in the knee-chest position. The *hand* may be carefully passed into the womb with the loop of cord protected in its palm, until the loop is carried above the equator of the head to the back of the child's neck, the fundus uteri being meanwhile supported with the other hand, and the head gently pushed aside when the inner hand passes alongside of it. When this proceeding is inadvisable, or impossible, from the head having descended too low, two or three fingers may be used to push up the loop, and hold it above the equator of the head until the latter is forced down by a succeeding pain, when the fingers are withdrawn. Repeat during several successive pains, if necessary.

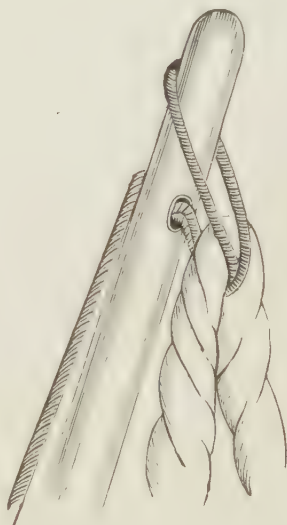
In lieu of the hand or fingers, various *repositors* have been devised. A tape and styletted male elastic catheter answer as well as any of them. A piece of tape three or four feet long is doubled, end to end, and passed into the catheter so that the tape loop can be drawn out an inch or two through the eye of the instrument. The stylet is also passed in, and its extremity made to project from the eye of the catheter.

FIG. 285.



Reposition of cord. (After
WITKOWSKI.)

FIG. 286.



Braun's reposition of cord. (After
WITKOWSKI.)

The loop of tape is next passed round the loop of cord, and hooked over the projecting end of the stylet, which last is pushed back into the eye, and shoved up quite to the closed end of the catheter. The two ends of the tape may now be gently drawn upon, until the loop loosely holds the cord in contact with the instrument. The prolapsed funis is then pushed up into the uterus by the catheter until it is quite

above the presenting part of the child, when, by withdrawing the stylet the cord is released. The catheter and tape may be left in till labor is over. *A simpler method:* The loop of

FIG. 287.

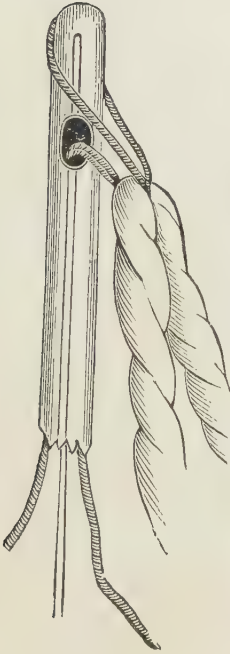


FIG. 288.



FIG. 289.



Other methods of reposition of cord.

tape, instead of being passed all through the catheter, is simply passed into the *eye* of it and over the end of the stylet, which last is pushed up to secure it; the free ends of the tape may now

be loosely tied round the loop of cord and the catheter introduced as before, and stylet removed. (See Fig. 285, p. 570.)

Or again, a catheter may be used with *two eyes*, opposite each other; the loop of tape or string is passed transversely through *both* eyes, then round the navel-string, then over the end of the catheter (see Fig. 286, page 570) when the ends of the tape, passing along the shaft of the catheter, are drawn tight enough to hold funis, etc. Stylet to be used for introducing it, and withdrawn afterward, leaving catheter, etc., in utero. Other methods of using the catheter, tape, and stylet are shown in Figs. 287, 288, and 289, which explain themselves. Retention of a replaced funis has been secured by attaching to the cord a collapsed elastic bag or pessary, having a tube by which it may be inflated, after introduction into the uterine cavity—so-called “ballooning” the cord.

When reposition fails, as it is often wont to do, the next element of treatment, generally speaking, is *speedy delivery*; or, when circumstances render this impracticable, it may be attempted to place the cord where it will receive a *minimum amount of pressure*. Thus, when the occiput is placed at one of the acetabula, the loop of the cord should be put near the sacro-iliac synchondrosis of the same side. In breech presentations put it near the sacro-iliac synchondrosis which corresponds to the antero-posterior diameter of the breech.

Speedy delivery may be secured by *forceps* when the os is dilated and the head sufficiently low.

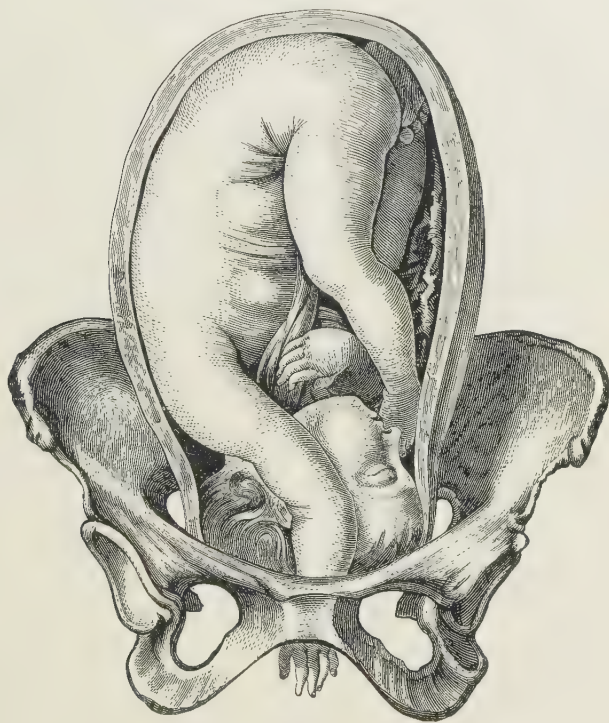
When forceps are not available, the next alternative is *version by the feet*, preferably by external or combined external and internal manipulation, and subsequent rapid extraction. The dangers of version, especially when the conditions for its easy and safe performance are not present, should, in the interests of the mother, be earnestly considered before the operation is agreed upon. It should be also ascertained that pressure upon the cord has not already so far injured the child as to render its chances of survival, after version, insufficient to justify any risk to the mother that may be incurred by the operation.

The operation of version, together with reposition of the cord, may be facilitated by putting the woman in the Trendelenburg posture.

In face presentations, when operative interference is decided

upon to save the child's life, an *early* resort to version is the best, that is, when other methods of relieving the cord from pressure have failed.

FIG. 290.



Hand prolapsed by side of head. The prolapsed cord is not represented.

In breech cases the extremities should be brought down, and the child rapidly extracted by the methods already stated. (See "Breech Presentations," pages 315-337.) In footling cases the same rapid extraction is necessary.

In cases of prolapsed funis associated with contracted pelvis or with transverse presentations, the treatment required for

these complications, in the interest of the mother, must take precedence of that solely relating to the interests of the child.

When prolapsed funis is associated in head presentations with coincident prolapse of a hand (see Fig. 290), the prolapsed extremity should be replaced with the funis, and the head made to descend and fill up the space so as to prevent re prolapse. Care must be taken not to displace the head and thus produce transverse presentation; it is best prevented by abdominal pressure during the proceeding.

When a foot presents with the cord and head, or when foot, hand, head, and cord all present at once, it will usually be best to draw down the foot, while the head, cord, etc., are pushed up, thus producing version by the feet. Such presentations are technically known as "*complicated*" or "*complex*" ones; and are also so called when the cord does *not* prolapse. (See "*Footling Cases*," page 337.) When the pelvis is large, prolapse of a hand alongside of the head may still admit of spontaneous delivery, or forceps may be applied if the extremities cannot be replaced and progress is much impeded by the complication. When the child is dead, prolapse of the cord requires no interference. In all cases where hope of life remains, prepare beforehand for resuscitation by providing hot and cold water, brandy, electricity, etc.

SHORT AND COILED FUNIS.

Actual shortness of the cord (cases have been seen as short as two inches), or *artificial* shortening by its being coiled around the neck, body, or other parts of the child, very rarely offers *considerable* mechanical obstruction to delivery, and more frequently a *slight* prolongation of the second stage of labor results. Very long cords, of even six or eight feet in length (such have been observed), may be practically short from coiling. From stretching of a short or coiled cord during labor there may result, though very rarely, inversion of the uterus, premature separation of the placenta and hemorrhage, rupture of the funis or interference with its circulation, and death of the infant. The strongest cords rupture under a tension of 15 pounds; the weaker ones bear only about 5 pounds; the average strength about 8 pounds.

Symptoms.—Before extrusion of the child's head, the diagnosis of a shortened funis is not always easy. The following symptoms may be present: A peculiar pain or soreness felt during uterine contraction, usually high up at the supposed placental site, which is described by multiparae as being different from the suffering produced by ordinary labor pains. Later on there is partial arrest of labor pains, especially of bearing-down efforts; and retardation in descent of presenting part, with elastic retraction of it, between the pains, to a greater degree than can be accounted for by resistance of maternal soft parts. Blood may be discharged before birth, owing to partial separation of placenta, and when there are no coexisting lacerations of cervix, etc., to explain it. Depression of placental site, during pains, felt through abdominal wall (?). An unusually persistent desire on the part of the woman to sit up, not occasioned by fulness of bladder or rectum. A finger passed high up into the vagina or rectum may feel an existing coil.

Treatment.—None is required in the large majority of cases other than release of a coil round the neck after the head is born. The coil is loosened by drawing it down to form a loop, which is then passed over the occiput. Harmless or at least remediable coils of this sort occur once in about every five labors. When the cord is too short to admit of release in this way, cut it after two ligations, and deliver at once, to protect the child from hemorrhage and suffocation.

When labor is unduly retarded from a short cord *before* the head is born, let the woman assume a sitting or kneeling posture upon the bed, and lean forward during the pains. The whole womb is thus pushed down and tension of the cord relaxed, while the head, if its rotation have not previously taken place, will rotate, and so be prevented from retracting between the pains, thus affording the succeeding uterine contractions a better chance of completing delivery. Should forceps be used in such cases, owing to symptoms of tedious labor, care must be taken not to invert the womb. A cord that is *very* short may require division, *in utero*, before the head can be safely extracted. Such cases are extremely rare. *Knots* in the cord do not impede delivery, but may interrupt the circulation and thus destroy life of fœtus when tightly drawn.

CHAPTER XXXII.

ANÆSTHETICS: CHLOROFORM, ETHER, CHLORAL, ERGOT, QUININE.

ANÆSTHETICS are used in obstetrics to lessen suffering produced by labor pains; to lessen the pain attending obstetric operations; to relax the uterus when its rigid contraction interferes with version; to promote dilatation of the os uteri; to reduce excessive nervous excitement which may interfere with progress of early stage of labor; to relieve eclamptic convulsions and mania; to relax the abdominal wall and lessen pain, while the uterus is being pushed down; in cases of abortion when the finger is being introduced to remove retained secundines; in craniotomy to forestall unpleasant recollections; in cases of uterine inversion to relax the constricting cervix and so facilitate replacement; in bipolar version to lessen pain of introducing the hand into vagina; in precipitate labor to suspend action of voluntary muscles and retard delivery; to dissipate "phantom tumors" while making a differential diagnosis of pregnancy; in all cutting operations upon the abdomen; and sometimes in sewing up a lacerated perineum when many sutures are required. In this last instance, and in all cases when an anæsthetic is used *after delivery*, the greatest care is necessary, for the reasons: (1) That the patient has usually lost some blood—perhaps a good deal; and (2) the reduction of abdominal pressure after delivery allows blood to flow from the brain toward the abdomen, hence a liability to cerebral anæmia and syncope. Anæsthetics after delivery should be avoided if possible.

The practice of giving anæsthetics in *all cases* of labor, to lessen pain, has been warmly advocated in certain quarters, but is not, on the whole, advisable.

Complete anæsthesia from chloroform or ether undoubtedly *lessens the force of uterine contraction*, and thus retards

labor, as well as predisposing to post-partum hemorrhage. Hydrate of chloral, on the contrary, may be given in sufficient quantity to procure relief from suffering without materially interfering with uterine contraction.

The choice between ether and chloroform—the two anæsthetics generally used—is unsettled; some prefer one, some the other. Ether is unquestionably safer; and while the advocates of chloroform claim that but very few deaths are *on record* from its use when administered with unremitting care and by the hands of an educated and experienced physician, yet these conditions cannot always be constantly assured. All men are human; the unremitting care will sometimes remit; oversights and diverted attention happen to all, and in obstetric practice, with its inevitable fatigue, loss of sleep, and anxiety, are more likely to happen than in other fields of professional work. Hence, as a matter of safety, I prefer ether. In cases of acute anæmia following profuse hemorrhage, all agree that chloroform is more dangerous than ether. Ether (sulphuric ether) may be safely given during the second stage of ordinary labor at the beginning of each pain, and during its continuance; and *should* be so given to lessen suffering when the agony is severe and the patient particularly sensitive; but complete anæsthesia and insensibility are not advisable, from fear of post-partum hemorrhage, against the occurrence of which a double vigilance is always necessary when anæsthetics have been used. Ether is not so liable to retard labor from lessening the force of uterine contraction as chloroform, but it is not entirely free from this liability. It is objectionable during the early stage of labor, and is distinctly *contra*-indicated when there is kidney disease. Ether is inflammable, and hence care is required in using it at night, and chloroform in proximity to the *light* of a lamp, candle, or gas jet, will decompose into hydrochloric acid and chlorine, thus producing a vapor that may irritate the air passages and lead to pneumonia.

Chloroform.—Chloroform, when given to lessen the agony of labor pains, as it often is in Europe, though much less frequently in the United States, is usually administered when labor is pretty well advanced—when the os uteri is well dilated, the head descending, and the pains are propulsive. A few drops are placed upon a handkerchief, and held near, not

close to the mouth, at the beginning of a pain, the inhalation being continued till the pain passes its acme, when it is at once stopped. Pure air should be breathed during the intervals. *Complete* insensibility is not desired; the woman should remain sufficiently conscious to converse. During the *early* stage of labor chloroform should certainly not be given merely to lessen pain. A mixture of one-third absolute alcohol with two-thirds chloroform is less objectionable than chloroform alone. All the uses to which chloroform may be applied in obstetrics may be attained by ether, with the exception that chloroform is better than ether when there is renal complication.

While it is generally admitted that chloroform is dangerous in cases of fatty heart and in cardiac valvular lesions, it has nevertheless been given in those cases without any apparent bad effects.

During obstetrical operations requiring anæsthetics, anæsthesia should be complete; if it be only partial, the patient is liable to toss about without any control.

In delivering with forceps, under anæsthesia, extra care is necessary to avoid pinching the soft tissues of uterus and vagina in the grasp of the blades, since the patient being insensible, cannot indicate by her complaints the occurrence of such a mishap.

Strong contractions of the uterus, rendering *version* extremely difficult and dangerous—or perhaps impossible—are at once relaxed by complete anæsthesia. The child having been turned, it should not be extracted until the womb has, at least in part, resumed its contractile efforts, so as to lessen the danger of hemorrhage.

When chloroform is given for puerperal eclampsia it should be administered just before the beginning of each returning paroxysm in time to prevent the seizure.

Chloral (Hydrate of Chloral).—Under its influence the woman may sleep during labor without any great suffering, being only aroused by the recurrence of pains, the agony of which is not then acute. It is especially valuable, as already indicated, when the os uteri is thin, rigid, and difficult to dilate; in fact, during the early stage of labor, when ether and chloroform are inadmissible. Chloral does *not* diminish uterine contraction. It, indeed, lessens the *frequency*

of the pains, but at the same time renders them *stronger* and *more efficient*, calms nervous excitement, and promotes dilatation of the os. Fifteen grains may be given in a little water or syrup of orange-peel every twenty minutes, until two, three, or (possibly) four doses are taken, according to the degree of somnolence produced. More than a drachm during the whole labor is seldom required. Serious and even fatal symptoms have resulted from too large doses.

It is distinctly *contra*-indicated in *organic* cardiac lesions, and its safety is very questionable even in *functional* disease of the heart.

In puerperal eclampsia chloral is a most valuable remedy, both during and after labor. Large doses of twenty or thirty grains may be taken; or twice this quantity may be given at once by enema, and repeated in a few hours if the spasms recur.

As a sleep-producer in puerperal mania chloral is better than opium, hyoscyamus, or any other narcotic. It may be combined to advantage with bromide of potassium (xv-xxx grains of each).

Bromide of Ethyl.—Bromide of ethyl has been employed experimentally as an anæsthetic in midwifery. Its utility has not yet been sufficiently demonstrated to warrant its recommendation. It requires the same precautions as chloroform in its administration, and shares the dangers of this latter drug.

Cocaine.—Spinal anæsthesia with cocaine has not yet been demonstrated to be advisable in obstetric practice, but the hypodermic injection of the drug into the cervix uteri appears more promising.

Ergot (Secale Cornutum, Ergot of Rye, Spurred Rye).—Though by no means allied in its action with anæsthetics, ergot may be here considered as one of the obstetrician's special medicaments. Its effect on the uterus is exactly opposite to that of ether and chloroform, with which, indeed, it is sometimes administered as a sort of antidote to their relaxing effect upon the uterine muscles.

When given in ordinary full doses (xx-xxx grains of the powder, or xx-xxx minims of the fluid extract, or ʒj of the tincture or wine) ergot produces, in the course of ten or fifteen minutes, strong contractions of the uterus, which, when the

drug is repeated so as to obtain its full effect, become *persistent* and *continuous* as well as *powerful*. This tonic and unremitting *persistence* of the contractions constitutes one of the chief drawbacks and dangers of ergot. If the child be still unborn, continuous pressure upon the cord, obstruction to the utero-placental circulation, and consequent injury or death of the fetus may result unless speedy delivery take place. Injury to the uterine wall from continuous pressure or actual rupture of it may result when there exists any mechanical resistance to delivery. Hence the following contra-indications to the use of ergot may be positively affirmed: Pelvic deformity; malproportion between the size of the child and pelvis; transverse and other malpresentations or positions of the fetus; undilated os uteri; resisting, rigid perineum. When powerful contractions are produced by ergot, as may happen from its injudicious administration by nurses and others, and the labor is *not* rapidly completed, forceps should be applied to relieve the child from danger, a procedure all the more imperatively needed if auscultation reveal irregularity or feebleness of the fetal heart. On the whole, it is a safe rule to abstain from giving ergot at all before the child is born, except in retention of the after-coming head in breech presentations, as already explained. Its administration in certain cases of placenta previa is generally recommended, as well as in accidental hemorrhage from separation of a normally placed placenta; but if the child is to be saved delivery must be expedited by every possible or practicable means. Ergot was formerly used to induce *premature labor*, but has now been abandoned for better and less dangerous methods.

The chief use of ergot in midwifery is to secure persistent uterine contraction after labor. It thus prevents hemorrhage and lessens tendency to after-pains.

Quinine (Quinia Sulphate).—Though not yet generally used in labor cases to reinforce feeble uterine contraction, it has proved of sufficient efficacy in this respect to warrant the hope that it may form a safe substitute for ergot during the first and second stages of labor. Dose, x-xv grains every three hours. Its efficacy in relieving after-pains has been previously mentioned.

CHAPTER XXXIII.

PUERPERAL ECLAMPSIA DURING LABOR.

PUERPERAL eclampsia, associated with *premature* delivery, due to uræmia, from albuminuria and renal congestion or inflammation during pregnancy, have been already discussed in so far as their etiology, symptoms, and *prophylactic* treatment are concerned.¹ Their *obstetric* treatment does not differ materially from that of eclampsia occurring during labor at term, here to be considered.

Puerperal convulsions during labor, beside arising from uræmia, may be due to other forms of blood-poisoning, viz., cholæmia (retention of bile); imperfect elimination of carbonic acid by the lungs; medicinal poisons, as lead, narcotics, etc.; septic poisons, as those of typhus and other fevers. The opposite conditions of congestion and anæmia of the brain may produce eclampsia; as may also general anæmia, plethora, hydræmia, and leukæmia. Convulsions often precede death from hemorrhage during labor. They may arise from violent emotional disturbance, or from reflex irritation due to indigestible food, fecal accumulations, a distended bladder, etc. The well-known increased excitability (so-called "convulsibility") of the nervous system in pregnant and parturient women predisposes to eclampsia from slight causes.

Symptoms and Clinical History.—Previous occurrence of decided renal symptoms, general dropsy, etc., during pregnancy, especially signs of impending uræmia.

Preceding the actual occurrence of a spasm there are irritability of temper, slight or severe headache, dizziness, spots before the eyes, impairment or loss of sight, *tinnitus aurium*, hallucinations, deafness, intellectual disturbance, unusual desire to sleep, with perhaps stertorous breathing, vomiting, etc. Some or all of these may be present.

The actual convulsion may resemble *epilepsy* or *hysteria*.

¹ See Chapter VIII, p. 145.

Text-books give *three* varieties; epileptic, hysterical, and apoplectic. Hysterical attacks are slighter in degree, not accompanied by albuminuria, and consciousness is *not entirely* lost. *Apoplectic* ones are rare, and are followed by complete coma and paralysis, due to effusion, or a clot of blood within the cranium. The *typical* puerperal convulsion is *epileptic* in character. It begins with rolling of the eyeball, puckering of the lips, drawing of the lower jaw on one side, bending the head back or toward one shoulder. Then follow twitching of the facial muscles and of those of the extremities; protrusion of the tongue; grinding of the teeth; violent jerking of the arms; in fact, clonic spasm of the *voluntary* muscles, and some of the *involuntary* ones, notably those of respiration; hence lividity of the lips and face, distended veins in the neck, and apparent impending cyanosis. At first, however, the respiration is hurried and irregular, hissing through bloody froth between the teeth. Urine and feces are sometimes involuntarily discharged. Duration of the convulsion from one to four minutes. Complete unconsciousness during paroxysm, the patient having afterward no recollection of it. The fits may recur at varying intervals of minutes or hours, and in varying number, from two or three to twenty, thirty, or more. They are apt to recur with the recurrence of a labor-pain. They sometimes come on *after* labor without having occurred before it. The uterus may participate in the spasm, and expel the child rapidly, an unusual result, not to be anticipated or waited for.

Prognosis.—Always serious to both mother and child, increasing in gravity with the severity of the symptoms and existing impediments to speedy delivery. The convulsions may persist even after labor. Fortunately they do not occur more than once in four or five hundred labors.

Treatment of Convulsions during Labor.—If possible, ascertain the cause. A history of uremia attends most cases, the treatment for which (purgatives, diaphoretics, certain diuretics, and methods of reducing renal congestion) has been already considered (Chapter VIII.). Should this treatment *not* have been previously employed, purgation may still be of benefit. A drop of croton oil or a fourth of a grain of elaterin may be placed on the back of the tongue if the woman be comatose; or if she can swallow, calomel and jalap may be given

by the mouth, or a concentrated solution of Epsom salt, repeated every 15 or 30 minutes.

The relief of convulsions meanwhile chiefly claims our attention. During the paroxysm, prevent the patient from self-injury and place a piece of wood, or a spoon-handle wrapped in flannel, or a folded napkin between the teeth to prevent the tongue from being bitten.

During coma *following* the convulsion, the tongue sometimes falls *backward*, closing the glottis and threatening suffocation. Pull it forward with a tenaculum or volsella forceps. When the fit is over the remedies are, in *decidedly plethoric* women, bleeding from the arm. It reduces cerebral congestion and vascular fulness—conditions indicated by a strong, full, bounding pulse and lividity of the face—and may prevent a fatal apoplexy.

After bleeding, or when it is not advisable, inject *large* doses of morphia ($\frac{1}{2}$ grain) hypodermatically, and repeat as often as the convulsions recur; as much as 3 or 4 grains may be given in 24 hours.

In place of the morphia, chloral hydrate in large doses—30 grains—every three hours, may be given, or twice this quantity by the rectum, if the patient cannot swallow.

Anæsthesia with *chloroform* may be resorted to on the approach of returning paroxysms.

The fluid extract of *veratrum viride* in large doses (10–20 minims), given *hypodermically*, has been successful in controlling the convulsions; the spasms cease to recur when the pulse is reduced to 60 per minute. One large dose (as above) is first given. This or a smaller dose may be repeated in thirty minutes, if required. When the pulse-rate has been reduced to 60, smaller doses of 5 minims may be continued at longer intervals, to keep it so. The *veratrum viride* and morphia may be given *together* hypodermatically, often with excellent results. In various hospitals convulsions have been treated experimentally on morphia *alone*, on chloral *alone*, and on chloroform *alone*. The best results were obtained from the morphia treatment. The next best was chloral.

As a general rule, it is advisable to deliver by forceps as soon as dilatation of the os uteri will permit; but this is not by any means always required. Should the convulsions have been sufficiently controlled by other remedies, labor may go on

and be left to complete itself, any violent efforts with forceps being liable to provoke a repetition of the eclamptic paroxysm. If the convulsions continue in spite of treatment, *delivery offers the only port of safety*. Then, if the os be not sufficiently dilated for forceps to be applied, it may be dilated or be incised by one or other of the several methods usually resorted to in the so-called *accouchement forcé*, now to be described.

FIG. 291.



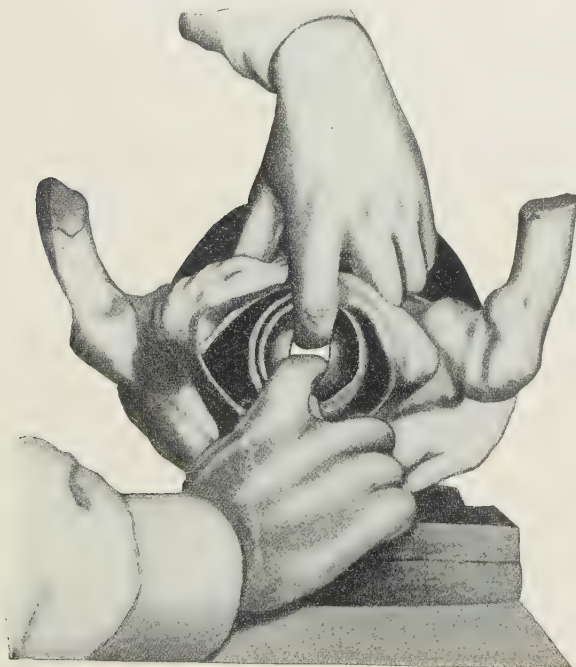
Rapid manual dilatation of os and cervix uteri by the Harris method.

Accouchement Forcé.—Rapid or forced delivery may be accomplished by mechanical dilatation of the os and cervix, either by the fingers or by steel dilators, or by the hydrostatic bags of de Ribes or Voorhees.

The best method of manual dilatation is that of Harris. (See Fig. 291). First the index finger is introduced, and

then withdrawn far enough to admit the tip of the thumb (as at 1 in the figure). Next push the tip of the finger toward the root of the thumb, and the tip of the thumb toward the root of the finger (2); then *two* fingers are introduced with the thumb, and their tips disposed in a similar manner (3 and 4); the same with the remaining fingers (5 to 10), as shown in the illustration.

FIG. 292.



Bimanual dilatation of the parturient os. (From JEWETT, after EDGAR.)

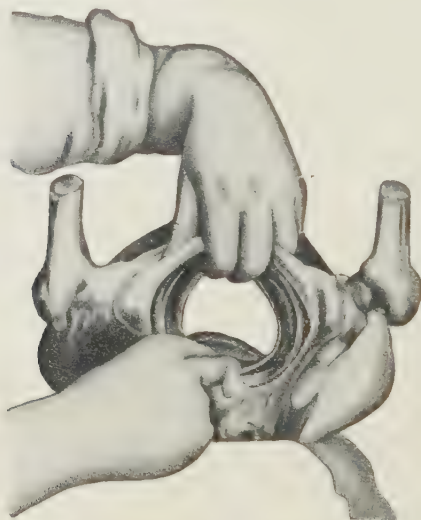
Edgar's Method.—The os uteri is first dilated with steel dilators until large enough to admit the index fingers of *both* hands, as shown in Fig. 292. The other fingers are successively introduced until dilatation becomes sufficiently complete and

the cervix is effaced. In Fig. 293 the os is about two-thirds dilated.

Fig. 294 (page 587) shows a photograph of the operation as performed at the Emergency Hospital, New York.

Another method is as follows: The patient is anesthetized, placed crosswise on the edge of the bed, her bladder emptied, and the parts made aseptically clean. The entire hand is now

FIG. 293.



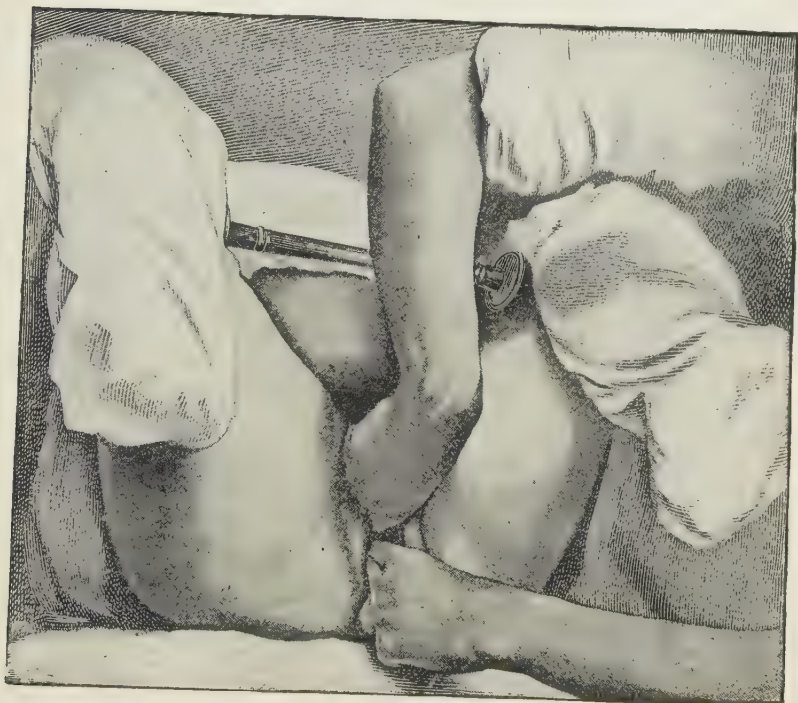
Bimanual dilatation of the parturient os. (From JEWETT, after EDGAR.)

passed into the vagina, and the first joint of the index finger passed into the os uteri.¹ During this and all subsequent parts of the proceeding counter-pressure must be made upon the fundus uteri by the other hand, or by the hand of an assistant, to hold the uterus in place against the pressure of the dilating fingers. One finger having been hooked over the rim of the os, steady pressure is made downward until a second finger can be made to enter; the two being held side by side so as to occupy as much space as possible. Next, one of the

¹ If the os be too small to admit one finger-end, as may happen in premature labors and in primiparae, it may first be stretched with steel dilators.

two fingers is partly withdrawn (all but its tip), thus making room for the tip of the third. The three are then pushed in ; and so the fourth, and finally the thumb. Then by expanding the five digits circumferentially, the widest part of the hand (over the knuckles) passes in and the os encircles the

FIG. 294.



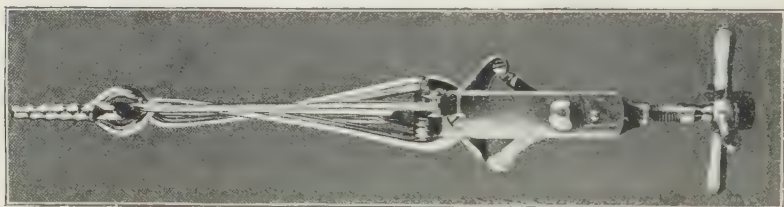
Bimanual dilatation of the parturient os. (JEWETT, after EDGAR.)

wrist. These are the steps, and thus easily we read them ; but the operation is often difficult and tedious, sometimes requiring an hour or more for completion. Moreover, it must especially be emphasized that in making pressure against the circular muscles of the resisting os, the force used must be

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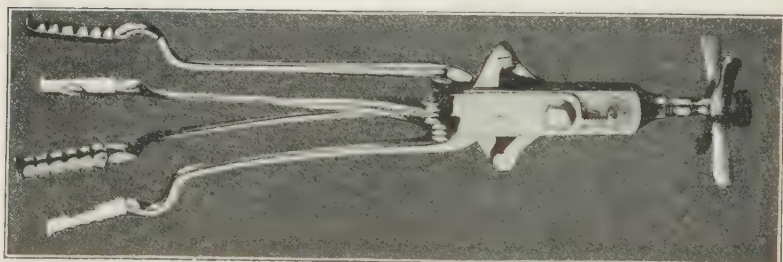
intermittent, in this wise: A certain amount of force having been used until the ring of the os is felt to offer distinct resistance, the dilating fingers are held *quite still* until the resistance is felt to *relax and disappear*, showing that the fingers have exhausted the resisting muscular ring by simple fatigue; then the fingers go in further until again resistance is encountered, and are so held until *this* resistance yields by

FIG. 295.



Bossi's dilator closed. (From DAVIS.)

FIG. 296.



Bossi's dilator open. (From DAVIS.)

fatigue, and so on step by step, until the process be complete. In difficult and tedious cases the hand may become cramped and useless, and must be taken out for rest before the dilatation can be resumed; or it may be continued by an assistant.

In all methods of manual dilatation it must be remembered that if only the ring of the *external os* is to be enlarged, it may be easily done perhaps within 10 or 15 minutes, but if a

cervical canal is to be effaced, it is difficult, and may require one or two hours.

Instrumental Dilatation with Steel Dilators.—The most approved device of this sort is Bossi's dilator (Figs. 295 and 296).

Frommer has modified Bossi's dilator; his instrument, consisting of eight blades instead of four, with an indicator attached showing the degree to which dilatation has progressed. And there are several others. Their mode of action is apparent; they are introduced closed, and by a screw device in the handle are slowly opened, so as to gradually stretch and dilate the cervix.

The methods of using the hydrostatic bags of Barnes, Voorhees, and Champetier de Ribes have already been described (pp. 484 and 485).

Incision of the Cervix.—The multiple incisions of Dührssen (usually four), one in the median line in front, one behind, and two lateral, extending from the external os to the utero-vaginal junction, are made as follows: The cervix is held by two pairs of volsella forceps, one on each side of the site of incision, by an assistant, then the operator passes the left index finger into the cervix and the middle finger between the cervix and vaginal wall. Along these fingers the blunt-pointed scissors (held in the right hand) are passed in, and the cervix is cut by one or two clips of the instrument. *More* than four incisions are sometimes necessary. After delivery the incisions are sutured. An aseptic technique is imperative.

Instead of several small incisions, one long one (sometimes two) may be made in the median line and extend through the lower uterine segment, almost to (but never into) the peritoneum, and the child delivered rapidly by forceps or version; so-called "*vaginal Cæsarean section*" (q. v., page 420).

Still again, delivery by the ordinary *abdominal Cæsarean section* constitutes another method of *accouchement forcé*.

Returning now to the treatment of eclampsia when the convulsions continue in spite of medicinal remedies, and the undilated os and cervix will not admit delivery by forceps or version, the obstetrician must decide as to what method of forced delivery will be best, remembering that speedy delivery in *some* way is the only hopeful resort. Much of course will depend on the capacity of the attendant—his surgical skill—and upon hospital facilities, assistants, instruments, etc.

The methods of digital dilatation will be best when the *os only* requires dilatation. When there is a cervical *canal* to dilate, a steel dilator may first be used, and when sufficient space is obtained, a Voorhees or de Ribes bag put in, for further expansion of the cervix. Forceps, or perhaps version for delivery when the "passage" is sufficiently open to admit the "passenger."

The next least harmful, and most generally available method will be the multiple incisions of Dührssen; or in place of any or all of these, the circumstances may be suitable to justify a skillful and opportune Cæsarean section, either vaginal or abdominal; but these last will rarely be admissible.

It is sometimes advantageous to rupture the membranes early, even before dilatation of the *os*, the pains afterward becoming more efficient and the tendency to convulsions diminished, owing perhaps to consequent reduction in the size and weight of the uterus and in its pressure upon bloodvessels. This of course should never be done in cases in which a version is anticipated.

The hot wet pack and vapor bath can be used to advantage even during labor, and without interfering with its progress, retained urinary excreta being thus eliminated with the profuse perspiration that ensues, or an entire hot bath may be employed, as recommended in Chapter VIII. (page 164). Elimination of toxins, both before and after delivery, may be further secured by the subcutaneous injection of normal salt solution, one or two quarts in 24 hours; or an enema of the same solution high up in the rectum or colon. Pilocarpine should not be given; it produces œdema of the lungs.

When the child is born it is well *not* to hasten the third stage of labor. A moderate loss of blood is beneficial, and within proper limits should be encouraged. In fact, when convulsions continue after delivery and the patient has not lost much blood, venesection should be done without hesitation, the proper repletion of the vascular system being renewed by the saline injections.

In all cases *absolute quiet* in a dark room is desirable; no noisy talking or walking, no slamming of doors or windows. Mechanical jarring of the bed will sometimes evoke a paroxysm.

CHAPTER XXXIV.

PUERPERAL SEPTICÆMIA.

PUERPERAL septicæmia (*older synonyms: childbed fever; lying-in fever; puerperal fever; etc.; modern synonyms: puerperal sepsis; puerperal infection, etc.*) is a fever beginning within a week after labor—usually from the third to the fifth day, inclusive; attended with *acute inflammation* of the reproductive organs (one or more) and with *septic infection of the blood* and general system. The local acute inflammations are simply local infections of the inflamed parts—their invasion by pathogenic microbes. The blood infection is produced either by the same pathogenic microbes invading the blood and multiplying in the circulation, or the blood is poisoned by absorption of ptomaines produced by the colonies of microorganisms existing in the inflamed organs. These two phenomena, viz.: (1) *Local* infections, and (2) *systemic* or *general* infections (so-called “blood poisoning”), must be constantly borne in mind. In some cases the *local* phenomena predominate; in others the *general* processes are the more pronounced; usually both are present in varying degrees.

Because the condition is attended with the symptoms of *fever*, and occurs during the *puerperal period*, it was called “*puerperal fever*.” Later, when it was found that the chief cause of death was septic poison in the blood, it became known as “*puerperal septicæmia*.” Neither term is sufficiently exact or comprehensive to include all the observed phenomena. And the term “*septic infection*” used by recent writers simply represents the *process* by which the observed phenomena are produced, or brought to begin; really the *cause* of the trouble. But the want of a suitable *name* is of secondary importance, if the *cause, prevention, and cure* of the pathological changes are sufficiently known. This knowledge has been

greatly extended by recent research, so that to-day certain well-established facts have been demonstrated, on which a system of prophylaxis and cure has been devised, greatly reducing the frequency and mortality of the disease. These facts will now be presented in as easily intelligible a manner as may comport with the brevity of this work.

There are two sets of phenomena to study, viz.: *First*, the *general* infections leading to systemic poisoning; *second*, the *local* infections leading to localized inflammations.

The *general* infections comprise three processes, viz., *sapraemia*, *septicæmia*, *pyæmia*.

The *local* infections comprise vulvitis, vaginitis, endometritis, metritis, salpingitis, ovaritis, parametritis, and peritonitis; that is to say, inflammation of the reproductive organs and their adnexa, the peritoneum and cellular tissue. Other organs, distant from the reproductive structures, *may* become involved secondarily by the floating off and lodgement of infected thrombi, as will be explained farther on.

Returning to the three forms of *general infection*, we find:

1. *Sapraemia*, caused by the absorption of toxins from the uterus or vagina, produced by the putrefaction of blood-clots, remnants of placenta, membranes, etc., left in the uterine cavity. The putrefaction of these lifeless remnants could never take place in the uterus (any more than organic matters would putrefy in the external world) without microbes; and the microbes concerned in these cases are the so-called *saprophytic bacteria*. The decomposition they produce leads to a foul-smelling, frothy discharge from the uterus, containing bubbles of offensive gas, much resembling ordinary putrefaction as known elsewhere. Consequent upon this process, toxins (ptomaines) are evolved which, being absorbed into the blood, poison the patient either mildly or fatally, according to the quantities absorbed—sometimes called “putrid intoxication.” The condition is easily amenable to treatment by *early* removal of putrescent matters and antiseptic cleansing of uterus. The putrefactive germs themselves do *not* really invade the *living* tissues of the uterus, nor do they enter the blood, but remain in the nidus of lifeless materials in the uterine cavity; hence this form of infection is not *generally* attended with local inflammation of any serious degree, and is therefore easy of cure and seldom fatal, thus contrast-

ing in a marked manner with the two other forms of general infection now to be considered.

2. *Septicæmia*.—This is a general infection produced by the absorption of toxins from living tissues that have become invaded by pathogenic microbes, thus producing inflammation, suppuration, and necrosis of the organs affected. This general septicæmic infection may be coincidentally accentuated by the microbes *themselves* getting into the blood, multiplying rapidly, and generating more toxins therein. In these cases the infecting microbes are, most frequently, *streptococci*; sometimes the *colon bacillus* or the *staphylococcus*; occasionally, the Klebs-Loeffler *bacillus of diphtheria*, or the *typhoid bacillus*. Mild infections occur from the *gonococcus*. Rarely still other forms of microbes are the infecting agents. The chief offender, however, is the streptococcus. The microbes (of whatever kind) invade the living tissues of the vulva, vagina, and uterus upon their mucous surfaces and penetrate deeper through the lymphatic channels, thus beginning in the lining membrane of the uterus (producing endometritis; penetrate to the muscular walls (thus metritis); then through to the periuterine connective tissue (parametritis); and finally reach the peritoneum with a resulting peritonitis. Of course such a commencing endometritis easily extends by continuity to the Fallopian tubes and ovaries, hence salpingitis and ovaritis. Thus occur all these forms of acute inflammation, and from one and all *toxins arise* which, being absorbed, lead to the *septicæmic* form of *general infection* we are now considering.

Since in passing from without inward, the microbes go by way of the *lymphatics*, this form of septicæmia is sometimes designated "*lymphatic septicæmia*."

3. *Pyæmia*.—Here we have a general infection of an entirely different origin.

The infecting microbes may be the same, but they produce a *general infection* by a different mechanism.

The streptococci first develop and multiply in the *thrombi of the placental site*; really, therefore, already *inside the venous channels* in which the thrombi have been formed. Thus occurs inflammation of the veins (phlebitis) usually first of the *uterine* veins themselves, but later other veins, those of the pelvis and sometimes of the lower limbs become inflamed, in this last case leading to crural phlebitis and *phleg-*

masia alba dolens. Worse still, the infected thrombi, wherever situated, are liable to break up and float away in small fragments to distant organs where, becoming arrested in vessels too small to allow their passage, they set up new foci of infection and consequent inflammation, going on to the formation of pus and so-called metastatic abscesses, perhaps in the lungs, liver, spleen, and joints, but no organ is surely exempt from the liability to these pus formations from the lodgement of fragments of infected thrombi. Thus from a primitive *local* infection of thrombi in the uterus arises the *general* infection known as *pyæmia*.

These three varieties of general infection (*sapramia*, *septicæmia*, and *pyæmia*), two or all may of course coexist in the same patient.

Next to *general* infections we must study the usually coincident *local* infections by which *acute local inflammation* of the organs is produced.

Thus, beginning with the *vulva* and *vagina*, we find *vulvitis* and *vaginitis*, in which these organs present the usual redness, heat, tenderness, and swelling, with mucous or muco-purulent discharge common to inflammations of mucous surfaces. Ulcers may occur, frequently beginning on tears made during labor. These ulcerated surfaces may present a diphtheritic appearance, being covered by a pseudodiphtheritic membrane. Usually this lesion *resembles* true diphtheria without being *really* so, but occasionally the Klebs-Loeffler bacillus may be demonstrated, thus showing a true diphtheritic infection.

Endometritis and Metritis. -The cavity of the uterus is the most frequent seat of puerperal infection and inflammation; and as these usually begin on the surface of the mucous lining of the organ, *endometritis* is the most common form of puerperal inflammation. From the mucous membrane infection and inflammation may extend to the muscular wall, producing *metritis*. In puerperal *endometritis* the infecting microbes penetrate into, breed in, feed on, and thus destroy the mucous lining, which thus breaks up into a necrotic mass of ulcerated and sloughing *débris*, which, when discharged *per vaginam*, may be foul in odor if the inflammation was produced by infection with colon bacilli or with saprophytic bacteria, but which may have little or *no* odor if the agents of infection were streptococci or staphylococci.

In cases in which the infecting microbes and consequent inflammation extend through the lining membrane to the muscular wall, *metritis* follows, in which larger and deeper sloughing processes take place, considerable masses of necrosed muscular tissue being sometimes thrown off (so-called *dissecting metritis*); or infected thrombi lodging in the uterine bloodvessels lead to pus collections and local destruction of tissue with necrosis.

As if designedly to prevent this deeper penetration of microbes from the mucous membrane into the muscular wall, Nature interposes between the superficial infected and deeper uninfected tissues a zone of resisting leucocytes—so-called “granular layer” of small-cell infiltration, through which the microorganisms as a rule cannot pass. In some cases they nevertheless get through and infect the muscular coat. This has been ascribed to the extreme *virulence* of the microbes (a term difficult to define), but is probably just as explicable by their greater *numbers* when first introduced, or by the constituents of the pabulum in which they grow, leading to their extremely *rapid multiplication*.

The difference in the *degree* of tissue-necrosis largely depends upon the *kind* of infecting organisms. In sapræmic cases due to saprophytic bacilli the inflammatory lesions are usually slight; in streptococcic infection they are more pronounced, and in mixed infections still more disastrous. Gonococcic infection, while not decidedly destructive, leads to chronic troubles, which often bring the patient after recovery into the hands of the gynæcological surgeon.

Salpingitis and Ovaritis.—Here the infecting microbes usually extend directly from the uterus into the Fallopian tubes and ovaries by simple continuity; more rarely they reach these organs by way of the lymphatic vessels.

Then follow the usual phenomena of inflammation in the tubes and ovaries, often going on to abscess of the ovary and to collections of pus in the inflamed and obstructed tubes. Here there is always danger that the ovarian abscess and pus-distended tube may burst, discharging their contained pus into the peritoneal cavity, with consequent peritonitis.

Parametritis.—This is inflammation of the *connective tissue* surrounding the outside of the uterus between the muscular wall and the peritoneum, sometimes called *cellulitis*, cellular and connective tissue being identical. Infection having

occurred in the uterine cavity or in lacerations upon the cervix uteri, the microbes make their way by the lymphatic vessels through the mucous and muscular coats to the peri-uterine connective tissue beneath the peritoneum. Inflammatory exudations take place which may disappear by resolution or go on to the formation of pus and abscesses beneath the peritoneum covering the uterus; or the infection may spread in many directions, following the various layers of connective tissue that accompany the peritoneum folds throughout the abdomen and pelvis, with corresponding pus formations which may discharge externally in the vicinity of Poupart's ligament, or internally into the bladder, vagina, or rectum, or unfortunately, into the cavity of the peritoneum.

Peritonitis.—Inflammation of the peritoneum results usually from infecting microbes having made their way from the interior of the uterus through all the uterine coats into the peritoneum, usually through lymphatic channels. Sometimes the peritoneum becomes infected from the bursting of abscesses of the ovary, tubes, and peri-uterine connective tissue, the infecting pus rapidly developing a fatal septic peritonitis. These cases are usually due to *streptococcic* infection, and the peritonitic complication is the worst and most mortal of all puerperal inflammations.

To recapitulate, we now understand that the process of septic infection in puerperal women leads to two sets of phenomena, viz.: (1) Systemic septic poisoning, either sapremic, septicæmic, or pyæmic; and (2) local inflammations, suppuration, and necrosis of the reproductive organs and of their adnexa, peritoneum, and cellular or connective tissue.

Etiology and Prophylaxis.—These two are almost necessarily inseparable, and may best be considered together.

Why is it that one woman, or a number of women, have no unpleasant symptoms after delivery and make a good "getting up," while another suffers and perhaps dies from one or more of the various troubles we have just described?

The answer is: The woman who escaped unpleasant symptoms did so simply because no pathogenic microbes gained access to her vulva, vagina, or uterus; or at least in insufficient number to produce recognizable unpleasant effects.

This being the *cause*, the *prophylaxis* is self-evident, viz., protection of the woman from microbes by *aseptic* and *anti-*

septic management during pregnancy, labor, and the puerperal period.

The recent history of obstetrics throughout the world demonstrates beyond a doubt that by the careful employment of a rigid aseptic technique puerperal fever can be prevented. This has been especially evident in maternity hospitals where the disease, formerly frequent and fatal, has been almost abolished; and the same could be said of private practice, if the rigid aseptic technique were carried out with the same care and fidelity as it is in well-regulated lying-in establishments.

Every labor case should be considered as a surgical case—a case of wounds—for there are always traumatic lesions, no matter how minute, upon the perineum, vulva, or cervix uteri, and always a larger traumatic surface from which the placenta was separated. It is the purpose of aseptic midwifery to protect these wounded surfaces from contact with microbes, which is to be accomplished by sterilizing the hands, instruments, fabrics, and appliances brought in contact with the patient, as previously described under Labor (Chapter XII.).

This is the pith and substance of cause and prevention. In addition it may be said that there is a possibility that the woman may have been infected—as by coition or self-examination, etc.—before labor began. Not only preëxisting gonorrhœal infection can be thus understood, but also streptococcic, diphtheritic, staphylococcic, and other infections. Pathogenic microbes often exist on the external genitals in moderate numbers in quite healthy individuals before labor, without any symptomatic evidence of their presence. But when *wounds* are added (as during labor), and when further, the processes of involution of the reproductive organs (as after labor) furnish a *lowly vitalized pabulum* in which microbes may grow and rapidly multiply, the small number of pathogenic organisms that were harmless on the outside, now get inside *via* the wounds, and multiply in numbers that are no longer harmless and latent, but sufficiently numerous to develop all the phenomena of septic infection.

It should be noted that the disease may be conveyed from an infected woman to a healthy one. Patients with erysipelas, diphtheria, carbuncle, and suppurating wounds are known to produce the pathogenic germs that in lying-in women lead to puerperal fever. Hence no obstetrician or nurse should go

from these cases to attend a labor case. Physicians have themselves been known to infect women, by having at the time of their attendance, in their own bodies, a muco-purulent coryza, a suppurative adenitis, and the remains of a dissecting wound. Physicians who dissect or make autopsies are liable to carry infection, at least from septic bodies, to their puerperal patients.

The air is sometimes the source of infection. It may be contaminated with microbes from other puerperal fever patients; streptococci have been found in floating air dust. Air may be rendered infective by sewer gas, by bursted waste-pipes, by the "contiguity of church-yards, dung-hills, privies, stables, slaughter-houses, cesspools," and many other places where the decomposition of organic matter is going on. A dead animal, even a rat or a mouse in the wainscot, may cause a dwelling to swarm with infecting germs.

Symptoms and Diagnosis.—In every case the constitutional symptoms indicating *systemic* infection begin with malaise, chilliness, or a distinct chill, followed by rise of temperature and the common phenomena of *fever*, viz., headache, thirst, anorexia, hot skin, furred tongue, frequent pulse, and the like. The degree to which these symptoms are exhibited vary in the three kinds of systemic infection.

In *sapremia* they are mild in degree, with no serious frequency of pulse or elevation of temperature. In nearly every case there is an abundant foul-smelling, frothy vaginal discharge.

In *septicemic* cases the chill is more decided, coming on early, about the third or fourth day, and the temperature higher, 103°, 104°, or 105° F., and remains elevated, with corresponding frequency of pulse, and general depression. In pure septicemic pure streptococcic—infection, even in the worst cases, there may be little or *no foul odor* to the discharge, thus contrasting decidedly with the milder sapræmic cases.

In *pyemic* infection the constitutional symptoms again vary; they come on later than the third or fourth day, and present the characteristics of *hectic fever*, that is, alternating chills, fever, and sweat, with remissions. The temperature is not *continuously* elevated, as in septicæmic cases.

In *mixed* infections these constitutional symptoms will not,

of course, present the typical characteristics of either of the three separate infections mentioned.

The absolute diagnosis of the kind of microbes present can only be *positively demonstrated* by a bacteriological examination, as stated further (on pages 601 and 602).

Symptoms and Diagnosis of the Several Local Inflammations.
—*Vulvitis and Vaginitis.*—The vulva and vagina present diffuse redness and swelling with heat, tenderness, and some pain when urine passes over the inflamed surfaces. Ulcers may appear superficially; or in very severe cases deeper ulceration and sloughing may occur. The ulcers may or may not present a diphtheritic appearance, which may or may not be really diphtheritic infection. There is a mucous or mucopurulent discharge.

Endometritis.—The uterus is larger, softer, and more tender on pressure than it should be. The lochial discharge may be increased or diminished, and in cases with very high temperature stop entirely. In sapræmic (putrid) cases, it will have a foul odor and frothy consistency, as already explained; in septicæmic (septic) cases there may be no odor and no gas-bubbles. In severe cases shreds of necrotic membrane and decidual *débris*, with blood and pus, come away in the lochia and impart to it a dirty or yellowish-green appearance. Ulcerations or lacerations visible on the cervix may present, as in the vagina, a diphtheritic character.

Metritis.—No well-marked local symptoms indicate extension of inflammation from the endometrium to the muscular wall of the uterus. The same symptoms exist as in endometritis, but the case does not progress so readily to a favorable termination, and is more likely to go on to inflammation of other structures, leading to parametritis or peritonitis.

Salpingitis and Ovaritis.—Pain and localized tenderness on pressure over the inflamed ovary and tube. On bimanual examination the vaginal finger may detect, on one or other side, a *distinct circumscribed mass*—the swollen and tender ovary or tube.

Parametritis (Pelvic Cellulitis).—Here the local symptoms are usually late in appearing; and resemble those of endometritis which may have partially disappeared, when renewed chilliness and fever again recur with increase of pelvic pain on one or both sides of the uterus.

The diagnosis is made by digital examination, revealing a firm, hard mass (of inflammatory exudate) on one or all parts of the vaginal roof, surrounding the cervix uteri, and rendering the uterus more or less immovable. The mass is tender on pressure. It may be absorbed or go on to suppuration and abscess, when the finger will recognize softening and fluctuation in the masses of inflammatory exudate.

Peritonitis.—The local symptoms vary very much according as the inflammation affects only the folds of peritoneum in the pelvic cavity (*pelvic peritonitis*), or extends to the peritoneum lining the abdominal cavity (*abdominal or general peritonitis*).

The symptoms of *pelvic peritonitis* are much the same as those of *pelvic cellulitis* (just described). There are the same local tenderness and pain, low down in the abdomen; the same areas of induration, going on to the same termination of suppuration and abscess, with about the same final results. The two inflammations often coexist. The treatment of both is similar.

Abdominal Peritonitis.—This is the much dreaded general peritonitis (*puerperal peritonitis*) by which the lives of so many women are lost. The symptoms begin by the initial chill and fever being severe, *very* severe, with continued high temperature (104° – 106° F.). Then follow intense pain over the entire abdomen, with extreme tenderness on pressure; even the weight of the bedclothes or slight vibrations from jarring the bed may be painful. Respirations are accelerated (25 to 50 per minute), short, and chiefly thoracic, owing to pain produced by movements of the diaphragm. Tympanitic distention of the intestine makes the abdomen tense and enlarged. The pulse is very frequent, and soon gets weak and thread-like. The woman lies on her back with the knees drawn up. Persistent vomiting and sometimes diarrhœa occur, and later on nervous symptoms, delirium, together with a coated, dry, and red or brown tongue, and all the signs of extreme exhaustion.

Phlebitis.—The local symptoms of inflammation of the veins from sepsis due to infected thrombi will depend upon the location of the affected vessels. When the veins of the pelvis and lower extremities (usually one, sometimes both) are infected and inflamed, the leg swells, becomes œdematous with tenderness and enlargement of the femoral or other

veins, as described in the chapter on Milk Leg ("Peripheral Venous Thrombosis," Chapter XXXV.).

In other cases the *joints* (wrists, elbows, ankles, etc.) become inflamed, as indicated by redness, tenderness, heat, pain, and swelling, and soon fluctuation occurs from formation of pus in the affected joints.

Infected thrombi lodging in the lung lead to broncho-pneumonia, a not unusual termination in fatal cases of pyæmic infection. Localized pain in the chest may be due to areas of pleuritic inflammation produced by lodgement of thrombotic fragments.

Thus, briefly, have we described the *general* symptoms produced by *systemic* infection, and the *local* symptoms resulting from the various inflammations.

With regard to diagnosis, it still remains to be said that fever—rise of temperature—may occur after labor from *other* causes, as from *mental emotion* or *excitement*, which, however, is easily recognized by the previous history of events by which it was produced, and by its being only *temporary*—passing away in a few hours.

Again, troubles about the *breasts* may cause fever. Examination by palpation and inspection will here render a diagnosis easy.

It is commonly believed that lying-in women who have been supposed to have a sort of *latent malaria* before labor exhibit symptoms of malarial fever (chill, rise of temperature, etc.) after labor is over. This is pure hypothesis. Such cases are *generally* ordinary puerperal infection. In malarial regions, however, true *ague* may occur. Diagnosis in doubtful cases can be made only by blood examination revealing the presence or absence of the malarial parasite.

So, again, lingering cases of moderate puerperal infection are sometimes confounded with, or mistaken for *typhoid fever*. Diagnosis can be made only by demonstrating the Widal reaction by blood examination.

Sometimes a rise of temperature occurs from accumulation of toxic matters in the bowels, the result of constipation. Diagnosis is demonstrated by the immediate relief afforded by purgatives.

In any and all cases of doubtful puerperal infection a positive diagnosis can *always* be made, not only of the infec-

tion *itself* but also of the *kind* of microbes (whether simply saprophytic bacteria, streptococci, or staphylococci, etc.), by making a bacteriological examination of the lochial discharge and demonstrating the presence or absence of pathogenic microbes and their kind. To ascertain positively whether the interior of the *uterus* be infected, it is necessary to obtain a specimen *directly* from the uterine cavity. To accomplish this Döderlein has constructed a device by which a small glass-sterile tube, attached to a small syringe, is passed into the uterus (the cervix having been previously drawn down to the vulva with a volsellum forceps and sterilized) without touching the vulva or vagina. Suction by the piston of the syringe draws a little of the uterine contents into the glass tube, which is then taken out, detached from the syringe, closed at both ends with sealing-wax, placed in a sterile test-tube closed by a cotton plug, and taken to the laboratory. The tube is now broken near the middle and its contents used for cultures and microscopic examination.

Fig. 297 (page 603) shows the small sterile tube contained in an ordinary (but sterile) test-tube, with cotton at both ends, for convenience of portage. In Fig. 298 the tube is attached to the syringe ready for use. Fig. 299 shows the tube with uterine contents, sealed at the ends, and later, broken in the middle, as described.

Prognosis.—This depends upon the kind and degree of infection and upon the site, extent, and number of local inflammations.

In some cases the systemic poisoning by absorbed toxins is so rapid and virulent that death may occur within twenty-four or forty-eight hours, before time has been allowed for any local lesions to develop. Such cases are now very uncommon, but were not unusual in former times, during epidemics, when women died as quickly as from plague or cholera.

"Pyæmia," with its attendant metastatic abscesses, is extremely fatal. "Sapremia"—putrid infection from ptomaines, due to decomposing materials in the uterus—is sometimes at once relieved and proceeds to immediate recovery after the putrescent matters are removed from the uterus. Combinations of "septicæmia," "pyæmia," and "sapremia," of course, increase the danger. The degree of danger from blood-infection in individual cases may perhaps best be indicated

FIG. 297.



FIG. 298.



FIG. 299.



Döderlein's syringe and tube.

by the pronounced *frequency and feebleness of pulse* and the occurrence of *delirium, stupor, coma, or other nervous symptoms*.

Of local inflammations, the most rapidly fatal is general *peritonitis*. *Pelvic peritonitis* is less immediately dangerous to life; recovery is the rule, but exceptionally pus may find its way into the general cavity of the peritoneum and lead to fatal abdominal peritonitis. Cellulitis has about the same risks as pelvic peritonitis. Ovaritis and salpingitis usually end in recovery or at least *partial recovery* (for such cases commonly become chronic ones, requiring removal of the diseased organs later on), but exceptionally pus from a diseased tube may find its way into the peritoneum and set up general peritonitis. The degree of danger in *metritis* varies with the extent of tissue involved—the prognosis must be always doubtful. In diphtheritic cases, in those accompanied with uterine phlebitis and consequent liability to embolic complications and pyæmia, the danger is great. The disease is liable to extend from uterus to peritoneum. Vulvitis and vaginitis, when existing alone, with proper treatment usually end in recovery. There is, however, always danger of other organs becoming involved, which increases danger. In diphtheritic cases the prognosis is more grave.

Every case of puerperal infection and inflammation must be regarded with *apprehension*. However mild in the beginning, no one can safely say how it will end.

Taking together all kinds of cases, mild and severe, the mortality with modern treatment is only about 4 per cent.

Treatment.—The *preventive* treatment consists in a rigid observance of aseptic precautions in all labor cases, and especially in cases requiring operative proceedings. The lying-in room, the air, the clothing and utensils, all instruments and appliances, the physicians and nurses, must be uncontaminated with germs, or rendered thoroughly aseptic by the methods already described under "*aseptic midwifery*" (Chapter XII., page 239).

The *curative treatment* will differ very materially in the different *local inflammations* and their progressive stages, but in the great majority of cases there are principles and methods of management that apply to nearly every case, whatever may be the site, extent, or degree of local inflammation, or what-

ever the kind and degree of blood-poisoning. Two things at least are of the utmost value, and in their curative influence probably far outweigh that of all other remedies combined. These two things are: First, *thorough aseptic and antiseptic disinfection of the parturient canal, from vulva to Fallopian tubes*; and second, *general support of the patient by food and stimulants*. This statement by no means detracts from the undoubted utility of such remedies as may be addressed to the *reduction of temperature, the relief of pain, the evacuation of pus, or the ablation of diseased organs* by surgical procedures and other measures; but *local antiseptics and general sustenance* apply to more cases and in the long run accomplish more good than can be credited to any combination of other curative agents. *Antiseptic disinfection* is accomplished chiefly by irrigating the vulva, vagina, and uterus with *antiseptic fluids*, by removal of septic masses of *debris* from the uterine cavity by the aseptic finger or curette and by the introduction into the uterus of antiseptic gauze, for the double purpose of disinfection and drainage.

With the results of recent experience in large hospitals, where many more cases are available for clinical experiment than in the private practice of individual obstetricians, it has been pretty well demonstrated that a too strenuously active method of treatment, such as has prevailed during the last one or two decades, is both unnecessary and harmful. Especially is this true with regard to the use of the curette. The finger is the best instrument for intrauterine use, both for detecting the *presence* of septic masses and for their *removal*. When no such masses can be discovered, the uterine cavity should *not* be scraped either with the finger or curette; a rough or even gentle use of the latter instrument leaves freshly wounded surfaces through which more germs may enter, and disturbs the protective layer of leucocytes. In *sapramic* cases, however, with decomposing clots, membranes, or placental *débris*, the removal of these by the finger is *imperative*, and the curette may sometimes be required to separate adherent masses.

So the routine practice of intrauterine douches of *antiseptic fluids* has been of late much questioned, douches of sterile water or of salt solution, it is claimed, are all-sufficient and preferable,

Again some, perhaps a good number of *moderate* septic infection cases get well without any local treatment. But nobody knows how soon a moderate case, without treatment, may become a severe one.

Therefore, notwithstanding differences of opinion which at present cannot be settled, there seems to be no good reason why either the douche, finger, or curette should be abandoned. In suitable cases each will find a proper use. It is their indiscriminate and routine use, without proper regard to circumstances, which modern obstetrics is striving to correct.

In irrigating the parturient canal the *vulva* and *vagina* should be *first* washed out, before the antiseptic solution is passed into the *uterus*, for the reasons that the vulva and vagina may be *infected* while the uterus is *free* from infection; hence by passing the nozzle of a syringe through an infected vagina into the uterus we should *carry* infection to the latter organ from the vagina. The solutions commonly used are the 2 per cent. creolin solution, the 2 per cent. carbolic acid solution, and the 1 to 3000 bichloride of mercury solution. Several pints of either solution should be prepared and introduced from either a fountain syringe or a Davidson's syringe, the nozzle being (preferably) a bent glass tube, with several openings on its sides, but none on the end, appended to the rubber tube. A bed-pan, or preferably a caoutchouc Kelly pad, receives the returning fluid, or a simple rubber cloth may be arranged under the woman's hips when she is brought to the edge of the bed, by which the fluid is conducted into a vessel on the floor. Irrigating the vulva and vagina is harmless and easy, but it requires to be done *thoroughly* by passing the syringe to every part of the vaginal canal. Irrigating the *uterine cavity* requires much more caution, and is not altogether free from danger—certainly not in *unskilful* hands. Care must be taken that no air be passed into the uterus by letting the fluid run through the tube in a full stream so as to expel any air it may contain before the nozzle is introduced into the womb. Care must also be taken that there is ample room for the fluid to escape through the os alongside of the tube, as fast as it goes in; otherwise the fluid may be forced into the Fallopian tubes and peritoneal cavity, or the womb will be distended, producing "uterine colic." In septic cases the os and cervix uteri are commonly sufficiently open to

easily admit the glass nozzle, and this last may be readily guided between two fingers of the left hand into the os and pushed with the other hand up into the cavity of the uterus without the aid of a speculum. The current—easily regulated by compressing the rubber tube—should first be slow, when, if it be seen to return freely, it may be allowed to run at full strength while the distal end of the tube is directed successively to all regions of the uterine cavity. (The glass tubes made for this purpose have a little protuberance on one side of their circumference near the end, to which the rubber tube is attached, to indicate the direction of the curve at the distal end of the tube when it is out of sight in the uterine cavity.) During the irrigation, if the current should cease to return freely, the glass tube may be pushed gently from side to side or pulled forward toward the pubes, so as to stretch open the os a little or dislodge from it some piece of clot or membrane by which the returning stream is being obstructed. Irrigation of the *womb* should be done by the physician and not intrusted to the nurse, unless, indeed, she be known to have acquired the necessary knowledge and skill. Recently it has been stated by Williams and others that irrigation of the uterus with sterile (boiled) water or normal salt solution is as effective as bichloride and carbolic solutions, and do not endanger poisoning of the patient by absorption of these drugs. In *sapraemic* cases especially, after putrescent materials have been removed by the finger or curette, it is claimed simple cleansing with sterile water is all-sufficient. In support of this view the experiments of Bumm are brought forward, in which he submerged infected *pieces* of liver in bichloride solution for thirty minutes and found that the disinfection scarcely extended below the surface. These pieces of liver, however, were *dead* tissue, while the uterus is *living* and absorbs some of the antiseptic solution into its lymphatic vessels (just as septic toxins are absorbed) following in the path of the microbes. Were this *not* so, general bichloride or carbolic poisoning could not take place, and it would not be necessary—as we find it after irrigating the uterus and vagina—to avoid leaving pools of the antiseptic solutions in their cavities to prevent this poisoning.

Use of the Finger or Curette.—When the uterus is suspected or known to contain tangible masses of putrescent or necrotic

material that cannot be brought out by irrigation, such as bits of placenta, membranes, or anything else, these must be scraped out by the finger or curette. The woman should be anesthetized, placed on her back, and brought to the edge of the bed. The *whole hand*, previously disinfected and lubricated with carbolized vaseline or mollin, is passed into the *vagina* and one or two fingers (rarely the entire hand) into the *uterine cavity*, counter-pressure being made over the fundus by the other hand upon the abdomen, when the fingers and finger-nails inside scrape off all adherent masses from the uterine wall and extract them. In case the uterus will not admit the fingers or hand, or when these for any reason are inefficient, the long, dull curette (a sort of artificial finger) may be introduced and the uterine cavity carefully scraped with caution to avoid rough manipulation and consequent perforation of the uterine wall; and also to avoid leaving any recess, notably the angles of the uterus near the openings of the Fallopian tubes, unscraped. In using the curette, the anterior lip of the cervix should be seized and the uterus drawn down to the vulva with tenaculum or volsellum forceps, as in gynecological cases. Should any remnants of adherent tissue be detected by the finger, the curette may be reintroduced and the mass scraped off. After all offending materials have been thus removed, the uterine cavity is irrigated with some antiseptic solution (creolin or bichloride) and packed lightly with iodoform gauze, or instead of the gauze, a suppository (so-called bacillus) of iodoform may be passed up with a pair of long dressing forceps and left in the cavity of the womb. The suppositories are prepared as follows:

R.	Iodoform		3v (gm. xx);
	Gum arabic	}	
	Glycerine		
	Starch (pure)		āā 3ss (gm. ij).—M.
Ft.	suppos. No. iij.		

These suppositories are about two inches long. They are passed into the cervix with forceps and then pushed up beyond the internal os with the finger.

In place of iodoform, Webster, of Chicago, uses a gauze tampon soaked in a solution of formalin (formalin, ℞ xxx;

glycerine, ℥iv ; sterile water, Oj), which he considers preferable to antiseptic douches, and also a more penetrating germicide. The gauze is left in the uterus twelve hours, then withdrawn and a fresh piece inserted after the use of a sterile douche. When the vagina only is infected a *vaginal* tampon of formalin is used in the same way.

This antiseptic cleansing of the uterine cavity, if done thoroughly, may not require to be repeated. In many instances its salutary influence is so well marked that pain, fever, and elevated temperature are at once relieved. Should these symptoms continue or return, the uterine irrigation may be repeated and another suppository of iodoform introduced, and so on for several days if necessary. Antiseptic douching of the *vagina* should be repeated twice or thrice daily in *all* cases, or even more frequently. The *temperature* of the antiseptic solution (whether used for uterus or vagina) should be pleasantly warm (about 100° F.) in most cases ; when, however, there is bleeding from the uterus, the fluid should be *hot* (100° to 115° F). Hot solutions, unless necessary for their hæmostatic effect are inadvisable on account of the smarting they produce.

General Support of the Patient by Food and Stimulants.—In all cases of blood-poisoning there is, as we have said in describing *symptoms*, great *general depression*, indicated chiefly by *frequency and feebleness of pulse*—a feeble *pulse* means a feeble *heart*. The heart-action must be kept up temporarily and *directly* by cardiac stimulants (by whiskey, strychnia, digitalis, strophanthus, etc.), permanently and indirectly by nutritious and easily assimilable liquid food (by milk, beef-tea, beef-extract, and other meat broths and animal juices).

Of the alcoholic stimulants—whiskey, brandy, etc.—it is impossible to say how much will be required. In some cases astonishing quantities may be given without intoxication. One or two tablespoonfuls may be taken either with water or milk or in the form of egg-nog, and repeated every three or four hours, to begin with, and the quantity and frequency of administration increased or diminished according to the effect produced and the requirements of the case. Loquacity and undue exhilaration indicate that too much has been given. Returning strength and reduced frequency of pulse indicate, without any signs of intoxication, the desired result of a

proper quantity. In place of, but preferably conjointly with alcoholic stimulants, strychnia (gr. $\frac{1}{30}$), or digitalis (fld. ext., gtt. i-ij), or tinct. strophanthus (gtt. iij-v) may be taken every four hours. The sulphate of quinia in five-grain pills every four hours is also useful both as a nerve tonic and to reduce temperature.

The liquid *foods*—milk and beef essence, etc.—must be given at frequent intervals, one or two hours, in small (tablespoonful) doses or more, as the stomach will bear. The more the better. If the patient have no desire for these things, they must nevertheless be taken, and at regular intervals, like medicines.

In addition to antiseptic disinfection, food and stimulants, *a laxative*, given early, when bowels are not sufficiently open, is advisable. Calomel, gr. v x, with double the quantity of sodii bicarb., or castor oil, may be given *once*. Sluggishness of the bowels having been relieved, the laxative must not be repeated.

For the *reduction of temperature*, the best and most agreeable method is sponging the surface with water or some evaporating lotion at a temperature pleasant to the patient, and drinking cool water freely. The use of medicinal antipyretics, including quinine, has of late been given up entirely.

To relieve pain morphine may be given. If it depress the heart, $\frac{1}{100}$ of a grain of atropine may be given with each dose.

The treatment required for special cases—for the various local inflammations—will now be considered.

Treatment of Vulvitis and Vaginitis.—The vulva and the vagina, by the use of a speculum, may be inspected and cleansed almost as easily as lesions of the skin. Infected perineal wounds require removal of sutures that they may be reopened and also made aseptically clean. In addition to irrigation by douches already described (see page 606), ulcerated surfaces upon the vulva, vaginal wall, or cervix uteri must be touched with a strong silver nitrate solution ($\bar{5}$ j to water, $\bar{5}$ j), or with pure carbolic acid or tincture of iodine. There is no positive evidence that one of these is better than the others. Should the ulcerations be diphtheritic, the same local applications may be used.

Treatment of Endometritis.—It is with regard to inflamma-

tion of the mucous lining of the uterus that there is at present so much difference of opinion as to the method of local treatment and disinfection.

Observe that the lesions are still in a measure *within our reach*; that is to say, the cavity of the uterus can be explored and local remedies directly applied. But note again, that this is as far as we can go; we cannot explore the Fallopian tubes and ovaries in this way, nor yet the muscular coat or peritoneal coat of the uterus, nor the cellular tissue between them, without a cutting operation of some sort.

It is important to remember, with emphasis, that endometritis is one of the most common lesions of puerperal infection; hence its local treatment has commanded special attention and interest.

The different methods of cleansing the uterine cavity by sterile water or normal salt solution, by antiseptic fluids, or by the finger or curette, etc., have been previously described. But the question as to when and how they are to be used in different cases remains unsettled.

No one disputes that in sapraemic cases—putrid endometritis—the decomposing matters in the uterus (whatever they may be) must be removed either by the finger, curette, douche, etc., as already described.

But in endometritis due to infection with streptococci (as demonstrated by a bacteriological examination) agreement as to treatment is still far away.

Perhaps in no instance is this disagreement more pronounced than in the difference of opinion between two of our most distinguished American authorities on obstetrics, whose textbooks, too, are much used by students; viz., Hirst, of Philadelphia, and Williams, of Baltimore.

Hirst affirms that "Locally, a thorough disinfection of the whole genital canal is called for in every case of puerperal infection," and adds that "it should invariably precede all other treatment."¹ In using the curette he observes, "the uterine walls are gone over thoroughly, but lightly, in all directions six to twelve times, until nothing is brought away but bright blood;" adding in a foot-note that the uterine walls must be scraped lightly so as "not to penetrate the layer of granulation cells under the endometrium." After curettage

¹ Text-book on Obstetrics. Edition 1903, pp. 721 and 722.

he advises irrigation of the uterus with sublimate solution, and if the uterus is large and flabby, with a tendency to flexion, a tampon of sterile gauze within its cavity.

Williams' Method.—When uterine infection is suspected, the uterine cavity is explored with a sterilized index finger. "If the uterine cavity is perfectly smooth, a douche of several litres of boiled water or normal salt solution should be given, but curettage should not be thought of. On the other hand, if its interior is rough and jagged, and contains more or less *débris*, it should be thoroughly cleaned out with the finger, after which an abundant saline douche should be employed. Curettage as a routine measure in all cases of puerperal endometritis is by no means to be recommended."¹ In many cases he says there is nothing to remove, and the curette breaks down the protective granular leucocytic wall. When the uterus *does* contain *débris* its removal is more readily effected with the finger than by the curette (*ibid*). Williams again discards antiseptic solutions (bichloride, carbolic acid, etc.) and uses a douche of boiled water or sterile salt solution instead.

In recapitulating the treatment of puerperal endometritis, he says: "If the bacteriological examination shows the presence of streptococci, all local treatment should at once be omitted. If, on the other hand, one has to deal with a putrid endometritis, and the symptoms do not yield to the first injection, additional douches may be given. When the infection has extended beyond the uterus, local treatment should not be persisted in, as it will do more harm than good" (p. 788).

It seems almost inevitable that the gentler method of Williams will supplant the more strenuous surgical methods of Hirst in general practice, especially with regard to the curette. While curettage of the uterus is properly relegated to the domain of "minor surgery," there are many obstetricians of small surgical experience who would hesitate to undertake even so simple an operation. The population of the world does not afford sufficient surgical work for all to become expert operators; these last must always remain in the minority. To the unskilled majority it may be gratifying to know that Williams' mortality in 52 cases of streptococcic endometritis was

¹ Text-book on Obstetrics. Edition 1904, p. 788.

only 4 per cent., there being but 2 deaths, and in these the streptococcic infection was associated with the colon bacillus, making a more dangerous combined infection.

In cases of endometritis with large flabby uteri, ergot should be given to contract the uterus and thus occlude lymphatic channels of infection in the uterine wall.

Treatment of Metritis.—In cases of endometritis, where the infection and inflammation have extended from the endometrium into the muscular wall of the uterus, with pus foci (abscesses) or purulent infiltration in various parts of the organ, the only hope appears to be the *early* performance of *hysterectomy*—extirpation of the diseased uterus.

It is unfortunate that the necessity for so serious an operation is difficult to make out—at least in most cases—before it is too late to prevent a fatal termination.

Treatment of Pelvic Cellulitis (Parametritis) and Pelvic Peritonitis.—These two inflammations, so frequently associated and so difficult to diagnose from each other, require about the same treatment. Unlike lesions of the vulvo-vagino-uterine canal, just previously considered, these inflammations cannot be directly approached with local remedies; they are beyond reach. The best we can do is to apply cold compresses (towels wrung out of cold water and covered with oiled silk or some other waterproof material) to the lower abdomen, to be changed every four hours. Ice-bags may be used instead of the compresses. In cases of great depression, or again when there is diarrhœa or enteritis, *hot* fomentations (or poultices) may be applied instead of cold, and hot vaginal douches of sterile water (110° to 115° F.) continuously for fifteen or twenty minutes thrice daily. These remedies are supposed to control inflammation and promote resolution and the absorption of inflammatory exudates; which last may be assisted by painting the lower part of the abdomen and the vaginal fornices with tincture of iodine. Ointments of iodine, ichthyol, and mercury are applied to the abdomen for the same purpose.

In case *suppuration* occur, the abscess must be opened (the presence of pus having been demonstrated by an exploring needle) either externally (usually near Poupart's ligament) or through the vagina, either behind the cervix or in one of the lateral vaginal fornices. Cavity of the abscess to be

daily douched with sterile salt solution and drained by strip of sterile gauze.

In opening abscess through the vagina, feel for pulsation of uterine arteries and avoid them. The ureters may be avoided by cutting *posterior* to an imaginary line drawn transversely through the cervical canal.

Most cases convalesce, but there is always danger of pus finding its way into the peritoneal cavity, thus leading to general peritonitis.

Treatment of Diffuse Abdominal Peritonitis.—Most cases die in spite of any treatment. A few may be saved by abdominal section, irrigation of the peritoneal cavity, and drainage. An incision is made in the median line of the abdomen through which an irrigating tube conducts an abundance of hot sterile salt solution, which is conveyed to every part of the cavity and made to return easily by keeping open the incision with the fingers and irrigating tube. The wound is then closed, except at its lower end, where a glass drainage tube or gauze strip remain in the wound and extend into the pouch of Douglas. Some operators prefer to add a wide opening *through* the Douglas pouch into the vagina; the pelvis being then packed with sterile gauze, a part of which extends into the vaginal canal, whence it may be drawn out in three or four days and a fresh one introduced from below. Through the incision in Douglas' pouch, irrigation of the peritoneal cavity with hot sterile water or saline solution may be done twice a day; perhaps for several days if the patient live so long. Should improvement occur, the gauze is finally withdrawn, the opening through Douglas' sac being left to take care of itself.

Should the above surgical method of treatment not be adopted, we may attempt to combat the inflammatory process by the same topical applications to the abdomen (either hot or cold) as already stated for pelvic peritonitis. The bowels must be kept free by small doses of calomel (1 grain every hour) or by Epsom salt; while abundance of liquid foods and alcoholic liquors are administered, the latter just short of commencing intoxication, to counteract the cardiac depression always produced by septic toxins.

Recent authors scarcely mention the *opium treatment* of general peritonitis nowadays, though Garrigues, of New York, not very many years ago claimed to have saved one-half of

his cases by the "opium plan." It consists in giving large doses (2 or 3 grains of opium, or an equivalent of morphia) every *two hours* until the patient is so far narcotized that the *respirations* are reduced to 12 per minute, at which point the breathing may be kept by regulating the doses and frequency of administration.¹ As a forlorn hope in the absence of surgical treatment it is worthy of trial, combined of course with whiskey, food, etc., and with enemas of castor oil, glycerine, and oil of turpentine to obviate constipation.

Treatment of Salpingitis and Ovaritis.—Here again the inflamed organs are beyond reach of direct local applications. The best we can do is to apply hot fomentations to the lower abdomen and give hot water irrigations *per vaginam* as already defined for pelvic cellulitis, etc.

When suppuration occurs, either in the tube or ovary, the abscess, if *adherent* and easily accessible from the vagina, may be opened through the vaginal wall (usually through Douglas' pouch), washed out, and packed with sterile gauze. If not so easily accessible from below, and movable, the mobility showing that adhesions have *not* taken place, the diseased ovary and tube should be removed by *cœliotomy*.

Treatment of Uterine Phlebitis.—Absolute rest, liquid nutrients, and abundance of alcoholic stimulants. The vagina may be cleansed by sterile water or salt solution, but the uterine cavity, unless it contain putrescent matters which *must* be removed, should not be disturbed either by the finger, curette, or syringe. After running a course of perhaps weeks or months, most cases recover under rest and nutrients. All manipulations in the uterine cavity are liable to displace infected thrombi from inflamed veins, start off floating fragments to lodge in distant organs, and produce metastatic abscesses and pyæmia, which is the great danger.

Abscesses in the viscera (lungs, liver, kidneys, etc.) are usually beyond remedy. Those in the joints require incision, sterile douching, and drainage, according to surgical rule.

In phlebitic cases where arrested thrombi have caused abscesses in the uterine wall, perhaps projecting externally toward the peritoneum, into which they are liable to burst and

¹ Alonzo Clark gave 934 grains of opium in four days; Fordyce Barker, 13,969 drops of Magendie's solution in eleven days; Lusk, 1700 grains of opium in seven days; Garrigues, 216 grains of *morphia* (1296 of *opium*) in twenty-three days. Lusk, p. 695; Saunders, p. 728.

discharge, hysterectomy is clearly indicated, but the difficulty lies in making a diagnosis of these conditions before the woman has become too weak to survive so serious an operation. (For the treatment of "Crural Phlebitis," see Chapter XXXV., page 624).

Treatment of Other Puerperal Inflammations.—Pleuritis, pericarditis, pneumonitis, hepatitis, splenitis, and endocarditis may be treated as in non-puerperal cases, with the addition of antiseptic cleansing of the parturient canal, together with alcoholic stimulants and food to combat the septic poison. *Cystitis*, usually produced by infection from a septic catheter, requires the bladder to be washed out with mild, warm solutions of creolin (1 per cent.) or of boric acid (20 per cent.), twice or thrice daily. Frequent micturition is to be relieved by suppositories of morphia. Extension of the disease to ureters and kidneys requires disinfection by boric acid solution through ureteral catheters; and sometimes when infection has invaded the substance of the kidney nothing but incision of the renal pelvis and drainage, or if one only be infected, extirpation of the diseased organ will be of service. As in the renal troubles of pregnancy, so in puerperal cases a *milk* diet and a free action of the bowels and skin will help to cure.

New Remedies.—Recently three new remedies have been used in the treatment of puerperal septicæmia, viz.:

1. Nuclein.
2. Hypodermoclysis of normal salt solution.
3. Antistreptococcic serum.

1. Nuclein (nucleinic acid) is supposed to increase the number of leucocytes in the blood. These leucocytes feed upon and destroy bacteria and other pathogenic microbes with which the blood may be infected. It is given hypodermatically, a 5 to 10 per cent. solution of the drug being used. The skin surface to be punctured is rendered aseptically clean by a 1 to 1000 solution of bichloride of mercury or a 5 per cent. solution of carbolic acid. The syringe is boiled for five minutes before being used. The puncture is made between the scapulæ, on the outer surface of the thigh, or into the gluteal region. Dose of the solution just named, 10 minims, gradually increased 5 minims for each successive dose, until 60 or 80 minims are given daily. It is also given in similar quantities by the mouth. Tablets of proto-nuclein, each con-

taining 2 grains, have also been prepared, of which one may be taken every two hours.

Beside promoting phagocytosis by increasing the white *corpuscles* of the blood, nuclein is also believed to increase the antitoxic and germicidal properties of the blood *serum*.

It has been used in cases of puerperal septic infection with apparent benefit, but always in *conjunction with other remedies*, so that its *individual value* as a curative agent cannot be definitely stated. It is, however, harmless, and there is sufficient evidence of its good effects to warrant its employment as above stated.

2. *Hypodermoclysis of Normal Salt Solution*.—The saline solution¹ is injected subcutaneously (with strict aseptic precautions as to instruments and skin surface to be punctured) in quantities of from one to six pints. A large aspirating or exploring needle is plunged under the skin, usually in the subclavicular region, under the mammary glands, or in the gluteal region. The needle is joined by a rubber tube to a glass vessel or rubber bag containing the solution of salt, thus the fluid is slowly transferred into the cellular tissue. The temperature of the solution should be 100° F.

It is supposed to act, like nuclein, by increasing the white cells of the blood, and by its rapid absorption, and subsequent excretion by the kidneys, is believed to promote the elimination of toxins from the blood. It is also in some sense a nutrient and support to the heart and general system. It has only been used *with other remedies*, so that its actual curative power remains to be determined. It may, however, be regarded as an eligible addition to our former recognized methods of treatment.

3. *Antistreptococcic Serum (Streptococcic Antitoxin)*.—This preparation consists of the blood serum of animals (horses and asses) that have been rendered immune against streptococcic poisoning by repeated artificial infection with cultures of the streptococcic microbes. It is made about on the same plan as that by which the antitoxin of diphtheria is produced.

It is given, always hypodermatically, always with rigid aseptic precautions, usually in doses of 5 to 10 cubic centimeters (approximately 81 minims to fʒiiss), once, twice, or thrice daily, but much larger doses—20, 30, and 35 cc.—

¹ For its preparation, see p. 165.

have been given at once in some cases, and in others the smaller doses of 5 or 10 cc. have been repeated every two or three hours. The size of the dose will depend, *first*, upon the *strength* of the preparation (for which we have to rely *entirely* upon the statement of the manufacturer); ¹ *second*, upon the severity of the case, larger or smaller doses being used according as the symptoms indicate respectively a very virulent or mild degree of infection to be overcome. Again, when symptoms abate, the serum may be omitted or used in smaller doses; when symptoms return the larger doses must be resumed.

In some cases the serum has apparently had a most marvelous and satisfactory curative power. When temperature has been very high, with frequent and feeble pulse, suppression of milk and lochia, delirium, dry, brown tongue, sordes on the teeth, offensive breath, and every indication of a fatal termination, after *one injection* of the serum, the bad symptoms have *all abated within twenty-four hours*, and the case gone on to uninterrupted convalescence and complete recovery. Such a good result is not always obtained, by any means. The remedy must be *used early*, before the various inflammatory lesions, especially pus formations, have had time to proceed beyond recovery.

In other cases good results have *not* been obtained, even though the serum *was* used early. In some this is accounted for by the complication of a mixed infection—some other infection beside that with the streptococcus, such as, for example, the staphylococcus, the *Bacillus coli communis*, the gonococcus, or the bacillus of diphtheria. In puerperal cases due to diphtheritic infection, however, the subcutaneous injection of diphtheritic antitoxin has sometimes been followed by the same beneficent curative effect observed to follow the use of streptococcic antitoxin in streptococcic infection. In short, the antistreptococcic serum will only be of service in streptococcic infection, and the diphtheria anti-

¹ In the cases thus far reported, Marmorek's serum, made by Alexander Marmorek of Vienna, and that prepared at the "British Institute of Preventive Medicine," have been mostly used. The serum is, however, now prepared in this country by Parke, Davis & Co., of Detroit, Gibier & Co., of New York, and some other manufacturers. The process is a delicate and complicated one. A horse is said to require treatment for several months—sometimes for a year—before its blood-serum will become suitable for use. The efficacy of any preparation must largely depend upon the method of production, as well as upon the age and preservation of the product afterward.

toxin only in diphtheritic infection. For cases of mixed infection, a mixed serum, not yet devised, would seem to be required.

Until we have learned to distinguish the various kinds of infection by *clinical symptoms*—a consummation not yet attained—we must ascertain the *kind* of infection by a so-called "*bacteriological diagnosis*." This is a necessity in order to use the serum advisedly. But it requires *time*. A cover-slip preparation may be made by *an expert* in fifteen minutes; a culture-tube preparation requires at least twenty-four hours, but both methods require special skill and apparatus.

At present it is not known whether the antistreptococcic serum acts as a germicide by killing the streptococci themselves, or as an antidote to the toxin produced by them, or in both of these ways. Yet if it cure the patient, that is the main point, whatever may be its *modus operandi*.

It is not justifiable at present to use the serum alone, to the exclusion of other remedies. Antiseptic douching of the genital canal, alcohol and other cardiac stimulants, with support of the patient by nutrients, have been and *should be used* in conjunction with the serum therapy. So, too, the administration of nuclein and subcutaneous injection of the salt solution have been and *should be used* conjointly with the serum.

Under these circumstances the individual value of the serum treatment, taken *alone*, remains to be determined. In some cases where it has been used, *no* benefit has resulted; some have grown *worse*, in others decidedly unpleasant symptoms, notably hæmaturia and cardiac depression, have been produced, while in a few cases death, apparently from rapid collapse, has been directly ascribed to the serum-treatment. It should not be used when there is renal disease, and in cases of simple sapræmia or putrid intoxication it would do harm rather than good.

Finally, it should be remembered that the mortality of puerperal infection under the treatment by antiseptics, food, and stimulants is only about 4 or 5 per cent., hence further experience is needed to demonstrate the *superiority* of the serum treatment.

Beside these three remedies, several others have been tried, but cannot at present be recommended, viz. :

Credé's Ointment.—An ointment containing 15 per cent. of collargol (a soluble form of silver) of which 2 to 3 gm. (15 to 45 gr.) are rubbed into the skin on the inner surfaces of the arms or thighs for 20 minutes, once a day, the surfaces being then covered with rubber tissue. Solutions of collargol have also been injected into the veins. The idea is to correct general septic infection.

Fochier's Method.—In *pyæmic* cases Fochier produced what he called *absces de fixation* by the subcutaneous injection of turpentine. If pus formed at the sites of injection and the abscesses were allowed to increase without opening, the result was thought to be beneficial. These abscesses were supposed to take the place of, and probably lessen the tendency to internal metastatic abscesses.

Kezmarzski, followed by *Rissmann*, attempted to correct sepsis by the intravenous injection of minute doses (1 to 5 mg.) of *corrosive sublimate*; and Barrows, of New York, made the same effort with minute quantities of formalin and formaldehyde, which he used in the same way.

Concluding Remarks.—The numerous and dreadful lesions caused by septic infection, and their fatal consequences, constitute the strongest sort of appeal for intelligent and painstaking *prophylaxis* which, while it may require time and care, will be as certainly effectual as anything within the range of medical science and will amply reward the conscientious obstetrician for any time and trouble he may expend in the attempt to attain a rigid aseptic *technique* in the practice of midwifery.

CHAPTER XXXV.

CENTRAL VENOUS THROMBOSIS, PERIPHERAL VENOUS THROMBOSIS, ARTERIAL THROMBOSIS.

CENTRAL VENOUS THROMBOSIS (HEART-CLOT).

BLOOD in the right ventricle of the heart coagulates, forming clot which plugs and perhaps extends into the pulmonary artery, thus usually producing sudden death by asphyxia in consequence of obstruction to entrance of blood current into lungs. In some cases the coagulation *begins* in the heart primarily, in others an embolus from a thrombus in some distant vein *lodges in the heart*, and this becomes the nucleus around which further coagulation takes place.

Causes.—Conditions by which tendency to blood coagulation is increased, viz. : 1. *Hemorrhage* either before, during, or after labor. Blood-loss is always followed by increase of fibrin in the blood retained. Increase of fibrin favors coagulation. 2. *Slowness or feebleness of blood current*; hence *syncope* (in which the heart is almost at rest), whether from hemorrhage, from exhaustion following a long labor, from sudden reduction of intra-abdominal pressure after rapid delivery, or from previous debility, favors coagulation. Great feebleness of the circulation, *without syncope*, may produce it. 3. *Septic infection* of the blood and accumulation in it of effete matters resulting from involution of uterus, etc. 4. *Excess of fibrin*, common to blood of pregnant women. 5. *Thrombi in other veins* may give off fragments (emboli) which lodge in ventricle or pulmonary artery, and constitute nuclei for growth of larger clots by accretion. Several of the above conditions may be combined in lying-in women.

Post-mortem Appearances.—Firm, leathery, laminated, and decolorized clots in right ventricle and pulmonary artery and its larger branches. Coexistence of thrombi sometimes in other veins.

Symptoms.—Sudden occurrence of intense dyspnoea and cardiac pain, preceded or not by syncope. Extreme pallor or lividity of face. Violent gasping and respiratory motions, which are short and hurried. Pulse thready, feeble, fluttering, or nearly imperceptible. Skin cool or cold. Intelligence may be unimpaired. Death may occur in a few minutes, or if obstruction in pulmonary artery be not complete the symptoms may ameliorate, but return repeatedly when patient attempts the slightest movement. Some live *hours*, some *days*; a very few recover. Cardiac murmur may sometimes be heard over site of pulmonary artery.

Diagnosis.—Dyspnoea and asphyxia, with sudden death, may be produced by entrance of air into uterine vessels at placental site, the air having reached the vagina and uterus by use of imperfect syringes; during manual and instrumental deliveries, from placing the woman in the genu-pectoral or latero-prone position; or sudden removal of abdominal pressure after violent pains that have expelled liquor amnii may if, vulva gape, produce aspiration of air into vaginal canal. Gases may be produced *in utero* from decomposition. Symptoms are nearly the same as in heart clot; so is treatment.

Sudden deaths from hemorrhage, shock, uterine rupture, and concealed bleeding from separation of a normally placed placenta have already been mentioned.

Treatment of Heart Clot.—*Prevent* the accident when, as after severe hemorrhage, etc., it may be anticipated, by keeping the head low and enjoining *absolute* repose in *recumbent* posture, not permitting the woman to elevate her head *for any purpose whatever*. *Treat* the accident, when it has occurred, by bold administration of *stimulants*—whiskey, brandy, ammonia, etc. Whiskey ($\frac{1}{2}$), sulphuric ether ($\frac{1}{2}$), nitroglycerin (gr. $\frac{1}{100}$), or strychnia (gr. $\frac{1}{30}$), may be repeatedly injected hypodermatically. Fresh air. Inhalation of oxygen. Milk and beef essence. Absolute and perfect rest. The slightest movement may be fatal. Apply warmth to the surface. Prolonged rest after subsidence of violent symptoms, until blood be restored by iron, quinine, and food.

PERIPHERAL VENOUS THROMBOSIS.

Clots of blood forming in the peripheral veins occur for the most part in the veins of the lower extremity or pelvis (notably in the crural, tibial, or peroneal), and thus leading to obstruction, produce swelling of the limb; hence peripheral venous thrombosis is the new name for old-fashioned "milk-leg." (Synonyms: "White leg," "phlegmasia alba dolens," "œdema lacteum," "crural phlebitis," etc.)

Causes and Pathology.—Conditions favoring blood coagulation (just mentioned as productive of *central* thrombosis) act as predisposing causes. The disease is apt to occur after placenta prævia or after manual extraction of placenta. Coagula from placental site may float into hypogastric veins and obstruct blood-flow through crural veins. Multiparity; feebleness and debility; difficult and complicated labors; inflammations about the pelvis following obstetrical operations; hemorrhages; septic infection; cancerous and other pelvic tumors; occurrence of erysipelas and of puerperal and other fevers during childbed may be set down as causes.

The disease may occur after abortion (especially when some part of the placenta has been retained), and sometimes it begins independently of both abortion and labor.

Formation of blood clots (thrombi) in the affected venous trunk is at present most generally admitted as the starting point of the *local* phenomena, though various other theories severally regard the venous obstruction as being secondary to phlebitis, cellulitis, lymphangitis, etc., and finally these local inflammations have been traced back to *septic infection*, which by most modern authorities is now regarded as the *real* cause and origin of the disease.

Symptoms.—Usually begin within one, two, or three weeks after labor. Premonitory *malaise*, depressed spirits, weakness, and irritability of temper. *Pain* in the limb, perhaps first referred to the hip-joint or inguinal region and then extending to thigh and leg, or may begin in the ankle or calf of the leg and extend upward. It is a dull, dragging pain, increased by motion. Chill followed by fever. Arrest of milk and lochial secretions. Pulse may reach 120; temperature 101° or 102° F., with evening exacerbation. Tongue coated. Bowels con-

stipated. Restlessness, sleeplessness, thirst. Chill, fever, etc., may be absent in mild cases.

Within twenty-four hours limb begins to *swell*; swelling increases until skin is tense, white, and shining from œdematous accumulation of effused serum in the cellular tissue. Complete *loss of power* in the leg, the patient being unable to turn it over in bed. Some *loss of sensation* in it, a "wooden" feeling. Its temperature increased. Affected vein or veins may be felt as thick hard cords, rolling under finger, red and tender. On the inside of the thigh the femoral sheath feels as large as a walking-stick; a red flush and tenderness on pressure mark its course. Glands of groin may be swollen, inflamed, and hard. Vulva also œdematous.

In a week or two both local and general symptoms abate. Swelling diminishes by absorption of effused serum, ending in recovery. Other cases terminate in suppuration and abscesses in the limb, pelvis, or lymphatic glands of groin. Rarely gangrene occurs. Floating fragments of thrombus may lodge in distant parts, producing metastatic abscesses in lungs, liver, joints, etc., with pyæmia, septic infection, and death.

In cases of recovery, some swelling, impairment of motion, and liability to relapse may continue for weeks or months.

Prognosis.—A fatal termination is exceptional. It is to be feared in pyæmic cases and in those attended with suppuration of the limb. *Complete* recovery as regards the limb itself may be long delayed, owing to partial or complete occlusion of venous trunk and its conversion into a fibrous cord.

Treatment.—*Absolute* rest on the back, perhaps for two or three weeks, the patient not being allowed to rise for any purpose; hence the use of a bed-pan is indispensable. The limb to be slightly elevated and wrapped in dry cotton batting or absorbent cotton and protected by a suitable screen from the weight of the bed-clothes. Anodynes to relieve pain, either internally or by liniments of laudanum, aconite, etc., applied *without* friction. The old "lead and opium wash" may be used. Williams obtains excellent results by painting the limb with a solution of ichthyol (15 to 20 per cent.). Rest and elevation of the limb are usually sufficient.

The "gentle frictions" formerly used to promote absorption had better be omitted entirely. *All* frictions are liable to dislodge a thrombus and cause it to float away to some more

dangerous locality. The limb may be painted with tincture of iodine, or ointment of iodine may be applied to promote absorption, but without any friction whatever.

Formations of pus (sometimes deeply situated in the cellular tissue of the limb) require free incision under aseptic precautions, antiseptic cleansing, and drainage according to surgical rule.

During convalescence an elastic stocking or elastic bandage is extremely useful to prevent swelling of the limb when the patient begins to walk.

The general treatment is the same as for other manifestations of septic infection, viz., *alcoholic stimulants* and *liquid foods*; and in cases occurring soon after labor, *antiseptic douches* to the genital canal must be used. In later cases—coming on three or four weeks after delivery—the douching may be unnecessary unless there be some indications for its employment, such as an offensive discharge.

Laxatives to relieve constipation, and anodynes (either Dover's powder or morphia), to relieve pain during early stage; and later, bitter tonics, tinct. ferri chloridi, quinine, and strychnia, will be necessary.

Alkalies given with a view to dissolve thrombi are uncertain and questionable, though recently *five-grain* doses of the potassic nitrate *every hour* during acute stage have been extravagantly extolled as producing convalescence in two or three days (?). The patient should on no account leave her bed until the thrombus has entirely disappeared and the vein become restored. Should she do so, it would endanger sudden death from the thrombus plugging pulmonary artery after displacement.

The almost hopeless pyæmic cases will require the same treatment as already described under Uterine Phlebitis (see page 615).

ARTERIAL THROMBOSIS AND EMBOLISM.

Very rarely clots (thrombi) form in the *arteries* of puerperal women, instead of, or as well as in the veins. They may also result from the breaking up of a venous thrombus, the fragments of which pass through the heart and go on in the arterial system until arrested by some artery too small to

let them pass. Such arrested floating fragments of a thrombus are called "emboli." Arrested detached fragments of "vegetations" from cardiac valves, following rheumatic endocarditis, sometimes occur.

Symptoms.—Symptoms depend chiefly upon the defect or arrest of function and nutrition of the particular organ or part whose artery has been obstructed by the clot. Paralysis and aphasia result from plugging of cerebral arteries, and blindness from obstruction in the ophthalmic. When the brachial or femoral arteries are the seat of thrombi, the respective limbs below the obstruction suffer a reduction of temperature, loss of motion and sensation, or instead of this last, severe neuralgic pain. Pulsation in the artery is lost *below* the obstruction and strengthened *above* it. Gangrene may occur when the collateral circulation is inadequate to sustain nutrition of the limb.

Treatment.—Rest and good diet with perhaps stimulants, and anodynes to relieve pain. In time the obstructing body will disintegrate or undergo absorption, but no treatment of which we are aware can hasten these processes. Gangrene belongs to surgery.

CHAPTER XXXVI.

INSANITY DURING GESTATION, LACTATION, AND THE PUERPERAL STATE, PUERPERAL TETANUS, ETC.

THE old term *puerperal mania*, inasmuch as it implies simple *mania*, and only during the puerperal period, is becoming obsolete. Viewed more comprehensively, mental derangements in the female having a causal relation with reproduction may be classified chronologically as follows:

1. Insanity of pregnancy.
2. Insanity of the puerperal state.
3. Insanity of lactation.

These, it is evident, may overlap each other or occur successively in the same patient.

The insanity, at whichever period it occurs, presents one of two special and to some extent opposite phases, viz., *mania* and *melancholia*. Both are sometimes combined.

Mania is characterized by paroxysmal violence, mental fury, raving, etc. *Melancholia* means continued despondency, steady gloom, quiet depression, suspicion, mistrust, etc. The mental atmosphere in *melancholia* is steadily dark from impending clouds; in *mania* it is violently agitated, as from a cataclysmic storm.

Causes.—The three varieties of insanity have certain causes in common, viz., hereditary predisposition; primiparity after thirty years of age; pre-existence of insanity, epilepsy, hysteria, dipsomania, and other neuroses are predisposing causes. During *pregnancy*, constipation, indigestion, mental worry from accidental circumstances adding to the depression and despondency common to pregnant women, as *e. g.*, seduction, desertion, etc., contribute to produce the disease. *Special* causes of insanity during the *puerperal* period are difficult, painful, prolonged, and complicated labors; post-partum hemorrhage; eclamptic convulsions; exhaustion and debility, as from over-frequent childbearing, from lactation during preg-

nancy, or from previous disease. Violent mental emotion as fright, shame, sorrow, etc. Septic infection and albuminuria with uræmic contamination of the blood are additional causes. Some cases occur from toxins absorbed from the intestine, owing to decomposition taking place in the contents of the larger bowel from constipation and defective digestion. The insanity of *lactation* is essentially a disease of debility and anemia, these conditions arising from prolonged lactation, frequent childbearing, post-partum hemorrhage, or other causes of exhaustion. An ill-nourished brain cannot perform its normal functions.

Symptoms.—The insanity of *pregnancy* commonly begins about the third or fourth month, or from then to the seventh, rarely later. Symptoms follow the *melancholic* type and are sometimes exaggerations of previously existing mental, moral and emotional disturbances, usually noticed as *signs* of gestation. There are headache, insomnia, gloominess, or irritability of temper, personal dislikes, etc., with tendency to suicide. Cure before delivery is exceptional, and there is liability to mania during or after labor.

The insanity of the *puerperal period* is most frequently, but not always of the *maniacal* type. In very painful labors, when the head is just passing the os uteri or perineum, a *temporary* frenzy or "delirium of agony," is sometimes suddenly developed, but *soon passes away*. This is *not* the kind of mania now under consideration. Puerperal mania *proper* begins usually within two weeks after delivery. It may be a week or two later. Sometimes it comes on within a few hours, rarely in a few minutes after labor. It may or may not be preceded by premonitory symptoms, such as restlessness, headache, insomnia, or sleep disturbed by painful dreams, manifestations of suspicion and dislike toward relatives and attendants, etc.; soon followed by incoherent talking, probably upon amatory, obscene, or religious topics. Patient steadily refuses to take food, and as excitement increases, refuses to stay in bed, tears off her clothing, screams, prays, attempts self-mutilation or suicide, or to inflict injury upon others. In time the paroxysm of mental excitement sobers down to melancholy, but fresh outbreaks are liable to occur on slight provocation. During excitement the pulse is accelerated and small. The digestive system is usually at fault, as shown by

furred and coated tongue and constipated bowels. The urine is high-colored, and often passes involuntarily ; there may also be involuntary stools.

When *mania* is absent, the *melancholia* symptoms are persistent refusal to take food ; insomnia ; intense depression ; religious or other delusions ; weeping ; praying ; gloomy silence ; tendency to suicide, infanticide, etc. Signs of digestive derangement.

The insanity of *lactation* is generally of the melancholic type, but may be associated with transient mania. It is much more common than insanity of pregnancy ; less so than that of the puerperal period. It is usually attended with symptoms of *anæmia*. May degenerate into dementia and hopeless insanity.

Prognosis.—As to *life*, the *puerperal* form, usually favorable, but not always. Extreme frequency of pulse, elevation of temperature, and coexistence of pelvic or other inflammations are of grave significance. Mania is more dangerous to life than melancholia. The prognosis as to restoration of reason is less favorable in melancholia. In this respect also, previous existence of insanity, or its coming on during lactation, or during latter half of pregnancy, are unfavorable, though not invariably so. Insanity coming on *early* in pregnancy and constituting simply exaggeration of usual mental eccentricity of gestation is less serious.

Sometimes weeks or months pass before a cure is effected.

There are no special post-mortem appearances other than those of *anæmia* or coexisting inflammations.

Treatment.—The transient frenzy of acute suffering during delivery is relieved by *anæsthesia*.

True insanity, at whichever of the three periods it occurs, and whether of the maniacal or melancholic type, requires remedies addressed to *general condition* of patient rather than to mental symptoms. No depletion is called for ; but on the contrary, *food, rest, sleep, and strengthening medicines*.

At the outset give a *laxative*, mild or stronger, according to strength of patient and previous constipation, but always with caution as to reduction of strength by excessive purging. After its operation, secure sleep by bromide of potassium (ʒss every eight hours) ; or if this be inefficient give with each dose hydrate of chloral, gr. xx. Thirty grains of chloral

with sixty of the bromide may be given by enema if patient refuse to swallow. Opium and morphia are, on the whole, objectionable—certainly so in mania cases; the latter may be given hypodermically in melancholia. In mania cases, paraldehyde in doses of one or two fluid drachms largely diluted, and hyoscyamine in doses of gr. $\frac{1}{100}$ to $\frac{1}{80}$ have been given with advantage to produce sleep.

Feed the patient with solid meats, if she will take them. If not, give beef-tea and as much *milk* as possible. The latter will sometimes be accepted as a drink when the patient declines to *eat*, especially when brought in an earthen instead of a glass vessel, and in a darkened room. Cold to the head, warm pediluvia, a bath of 90° F., or the hot, wet pack for refractory patients, assist in promoting sleep.

In cases with intestinal indigestion indicated by offensive and flatulent discharges, a purge of calomel and soda followed by naphthalin in doses of 5 to 15 grains three times a day, and washing out the bowel with antiseptic solutions of borax, carbolic acid, or sodium hypochlorite will not only correct the intestinal trouble, but also indirectly produce sleep.

Good nursing is of great importance. Every patient should be constantly watched, to prevent self-injury, but without her being aware of it, if possible. Strangers are more acceptable to most patients than husband, relatives, and friends. The bladder and rectum require special care to secure their being regularly evacuated at proper intervals. Beware of bedsores. Great tact is necessary by firm yet gentle persuasion to induce the woman to take food. Its artificial administration by force is seldom advisable, though sometimes necessary. The room should be quiet and dark. The woman must not nurse her child.

Insanity coming on during lactation *always* requires immediate weaning of the child, and in addition to food, sleep, etc., iron and quinine are necessary to restore the blood.

The propriety of sending patient to asylum depends much on facilities for good nursing at home. When the latter are wanting, an asylum is demanded. Mania being of shorter duration than melancholia, and less likely to be followed by confirmed dementia, may be managed at home in most instances. In chronic melancholia, sending the patient to an asylum should not be unduly postponed.

During convalescence, avoid all sources of mental excitement. Continue careful feeding, sleeping medicines at night, laxatives, and tonics until strength is fully restored, when change of scene and cheerful surroundings complete the cure.

PUERPERAL TETANUS.

Resembles ordinary surgical tetanus. Very rare in temperate climates, less so in tropical ones. It occurs after full-term labor, but more frequently after abortion.

Causes and pathology probably the same as in surgical tetanus. The greater number of recorded cases has followed *instrumental abortion or operative measures* to empty the uterus in abortion cases. It is probably due to infection from introduction of a specific microbe at the site of some traumatic lesion, whether the latter be from operative proceedings—surgical or obstetrical—or lacerations incident to labor. Exposure to cold and damp or to draughts of cold air is an especial exciting cause.

Symptoms.—Pain and stiffness in muscles of neck and jaw ; nervousness and agitation ; rise of temperature. The muscular stiffness increases, soon leading to lockjaw, and later to general attacks of painful spasm, opisthotonus, etc. The general spasms are easily provoked by slight shocks, noises, or jars about the room and bed, or by attempts to take food. Swallowing soon becomes impossible ; hence nutrition fails, and in a few days, varying from one to three or four, the patient dies from exhaustion and interference with respiration. Some die in a few hours ; about 10 per cent. recover.

Treatment.—Antiseptic irrigation of uterus and vagina. Internally : chloral, opium, the bromides, Calabar bean, cannabis indica, and curara, as in ordinary surgical tetanus. Anæsthesia affords only temporary relief from spasm and suffering. Nutrient enemata and inunction of the skin can be tried to support the patient when deglutition is impossible. Tetanus antitoxin is deserving of trial.

TETANY (TETANOID CONTRACTION).

This is a derangement occurring in nursing women, or during pregnancy, in which there is painful cramp or spasmodic contraction in one or more *fingers* or *toes*, beginning here and advancing up the limbs, in severe cases to the neck and trunk. The contractions are intermittent, and differ from tetanus in beginning in the extremities instead of in the neck and jaws. The contractions are sometimes painful, at others they begin with tingling sensations, and again there may be anesthesia of the affected parts. It is rare. Sometimes they may be simply hysterical. Among the *causes* are blood loss, prolonged lactation, diarrhœa, this last suggesting that the cramps are identical with those of cholera or choleraic diarrhœa. Most cases recover. It is *treated* by antispasmodics, opium, chloral, valerian, bromides, etc., and by arresting the diarrhœa, overlactation, or whatever condition may exist as a cause of exhaustion.

CHAPTER XXXVII.

INFLAMMATION AND ABSCESS OF THE BREAST— LACTATION AND WEANING.

INFLAMMATION OF THE BREASTS (MAMMITIS; MASTITIS).

INFLAMMATION may attack the *substance of the mammary gland* itself ("glandular mastitis"), or the layer of cellular connective tissue lying underneath the gland, between it and the pectoralis major muscle ("subglandular mastitis," or, more properly, submammary cellulitis). A more circumscribed form of inflammation occurs in the subcutaneous tissue immediately beneath the areola of the nipple (subcutaneous mastitis).

Either variety of inflammation *may* terminate in resolution without suppuration taking place; but in every case an opposite termination is to be feared, viz., the formation of pus, and consequent "mammary abscess" ("gathered breast").

In "*glandular mastitis*" the inflammation and suppuration (when the latter occurs) are usually confined to one lobe, or to two contiguous lobes of the gland, but when the abscess has discharged its contents, the inflammatory and suppurative processes may go on to the next adjoining lobe, and so on to another and another, until a greater part of the gland is destroyed by the succession of abscesses, the woman becoming meanwhile seriously or even dangerously debilitated by continued suffering and exhausting purulent discharges.

In *submammary cellulitis* inflammation is more diffuse, not confined to the vicinity of any particular lobe of the gland; and when pus forms, it is apt to infiltrate itself between the gland and chest-wall, separating the one from the other, or leading to long, sinuous tracts which eventually form fistulous openings through which matter is discharged. In neglected cases the fistulous orifices may enlarge by sloughing of their

borders into ulcerated surfaces of considerable size. In one such case I was able, by lifting the gland away from the chest-wall, to look in at one fistulous ulcer and see daylight admitted through others on the opposite side.

This form of inflammation may begin *de novo*, as a cellulitis, or the latter may be associated with or produced by inflammation of the gland itself, the glandular abscess, when deep-seated, discharging its pus posteriorly into the cellular tissue lying beneath the gland. It is not of frequent occurrence.

The "*subcutaneous*" form of mastitis usually terminates in suppuration, forming small abscesses or boils in the vicinity of the areola, their opening sometimes forming fistulous communication with the milk-ducts.

Causes of Mammary Inflammation.—The most common cause is *septic infection* of the breasts (through erosions and fissures of the nipple, or through the external orifices of milk-ducts), and rapid propagation of microbes in *accumulated engorgements of stagnant milk* within the ducts and acini of the glands. Micrococci of various kinds (the *Staphylococcus pyogenes aureus*, *Staphylococcus pyogenes albus*, the diplococcus, the streptococcus, and various forms of bacteria) have been found in the *milk* and the *pus* of inflamed breasts. If the nipples were always kept absolutely aseptic, and no stasis of accumulated milk was ever allowed to take place (a thing much more easily said than done in private practice), inflammation and abscess of the breast would probably never occur, except in rare cases of *traumatic injury*.

Women who have once suffered from mammary abscess are liable to do so again at succeeding lactations, probably because cicatricial adhesions and contractions have produced obstruction in some of the lactiferous ducts. Those who do not attempt to nurse at all are peculiarly exempt from mammary inflammation; while in those who begin to nurse and then stop, the affection is most apt to occur.

Symptoms.—Inflammation of the breast, of either variety, may or may not be preceded by excoriation or fissures of the nipple. So, too, a lump may form in some part of the gland from accumulation of milk, and be attended with some slight tenderness on pressure, but yet be dissipated under proper treatment without inflammation taking place. Such an indurated

nodule, however, is never safe from superadded inflammation upon very slight provocation. When the inflammatory process really begins, the symptoms are chill, fever, rise of temperature, hot skin, frequent pulse, headache, thirst, anorexia, etc.

Locally, lancinating pain in the breast increased by pressure, increased hardness, heat, swelling, and at first very slight redness.

Should the case terminate in resolution, the symptoms gradually disappear in a few days. When it goes on to suppuration the symptoms increase in severity. There are constant throbbing pain, increased tenderness and swelling, decided redness with slight lividity and heat of skin over the inflamed part, which also appears glazed, shining, and œdematous. The hard lump has now become soft and fluctuating; the latter, however, by no means distinct at first or when the abscess is small or deep-seated. The fever is continuous, but liable to exacerbations following slight rigors, occurring several times a day. If left alone, the pus eventually makes its way to the surface, the abscess bursts and is discharged, greatly relieving the pain and tension, and either recovery soon follows or subsequent renewed attacks develop later, as before described.

Inflammation *without* abscess occurs most often within the first week after delivery. Inflammation *with* abscess is more frequently a later occurrence, coming on in three or four weeks after labor, or again, the acute symptoms of inflammation may apparently disappear, leaving only a feeling of weight with some pain and tenderness, and yet suppuration may occur, even after several months.

The symptoms now described occur, varying in degree with the extent of inflammation in each variety of mammitis. When, however, the subglandular cellular tissue is inflamed, a few of the symptoms are considerably modified; thus the whole breast is swollen and tender instead of there being one special point of tenderness, and every motion of the arm produces pain, owing to the movement of the chest muscles underneath the gland. The pus is slow in coming to the surface; may accumulate in large quantities before doing so, and lead to severe constitutional disturbance and numerous fistulæ and sloughing ulcerations.

In protracted cases of either form of inflammation, accompanied with profuse and prolonged purulent discharge, symptoms of prolonged exhaustion and debility may ensue.

Mammary abscess usually affects one breast only, though sometimes both. The secreting function of the diseased gland, though not at first necessarily arrested (for the healthy lobules continue their secretion), is eventually lost from the necessity of withholding the child from suckling the inflamed breast. When, however, the inflammation has been only slight and the abscess small, lactation may often be resumed after convalescence.

Treatment.—*Prophylactic* treatment consists in keeping the nipples aseptically clean by applying boric acid solution (see “Chapped Nipples” p. 276) and in preventing engorgement of the breasts by accumulated milk.

Curative Treatment.—In the very beginning try to get rid of inflammation without suppuration taking place. In each variety of the disease enjoin rest in bed with rest of the inflamed organ by not allowing the child to suckle from it. Keep down the secretion of milk by saline cathartics and abstinence from fluids. Apply over the entire breast extract of belladonna, ℥j, mixed with linimentum camphoræ, ℥j, or instead of this, the lead and opium wash may be constantly applied on patent lint covered with oiled silk.

R.	Plumbi acet.,	℥ij ;
	Ext. opii,	grs. xvj ;
	Aquæ,	Oj.—M.

Painting the breast with tincture of iodine once during the first twenty-four hours is an excellent abortive measure. Combined with these medicinal applications, cover the inflamed organ with a bandage cushioned inside with cotton wool so as to make even and systematic *compression*. Add one thing more, viz., *dry cold* by keeping constantly over the inflamed breast a bladder or thin rubber bag filled with cracked ice. Fissures or erosions about the nipple should be made aseptically clean and then painted with a nitrate of silver solution (grs. xx, to water, ℥j) before the other applications are put on. Instead of ice applications, *hot* ones (flaxseed-meal poultices) are used. Resolution may occur with either plan. The *cold*

applications are better during the early stage of inflammation and may be changed for *hot* ones when suppuration seems inevitable, to hasten that process and bring the pus toward the surface. But in most cases neither heat nor cold will be required, the more convenient systematic compression of the inflamed breast with dry cotton being all-sufficient.

In cases where accumulation of milk in the inflamed breast is *very* great, and not relieved by the remedies given, it may be necessary to mitigate the tension by gentle expression with the hand, previously anointed with camphorated oil; but on the whole, breast-pumps, suckling, and manipulations are not generally advisable, on account of the irritations they produce. The child may generally be allowed to suckle from the healthy breast, but when the mother is much reduced in strength, or when suckling the one appears to keep up engorgement in the other inflamed side, the child should be weaned altogether, with a possibility of lactation being resumed after recovery.

When *symptoms of suppuration begin*, the local treatment consists in the *very early* evacuation of pus by incision. Even before perceptible fluctuation, and when in doubt as to the existence of pus-formation, the case should have the benefit of this doubt, either by puncture with an exploring needle or deep penetration by a small bistoury. The patient having been anæsthetized, and pus having been demonstrated by this exploration, a free incision, sufficiently large to admit the finger, is made in a radiating direction from outside the areola of the nipple toward the circumference of the gland (so as to avoid cutting across the milk ducts). The finger must then enter the incision and abscess cavity and fearlessly break up all pockets of pus, so as to leave only one continuous sac. This is then irrigated freely with boric acid or normal salt solution and lightly packed with sterile gauze, and the whole breast bandaged. The irrigation, replacement of gauze, and bandaging to be repeated once daily until the discharge becomes trifling, when the packing may be omitted and a smaller strip of gauze being introduced for drainage, the breast is more tightly bandaged, so as to bring the walls of the empty abscess cavity together. In a few days the cure becomes complete.

Should there be two abscesses in different parts of the gland, each one must receive the same treatment separately, but this

is unusual. If, however, the evacuation of pus was *delayed*, the whole process may repeat itself, and require the same treatment over again. Hence the early incision for the discharge of pus, even before we are absolutely positive that it is present, is a most important factor in promoting rapid cure.

Instead of the *gauze* drain after incision, some prefer rubber drainage tubes through which fluids may be injected for irrigation.

In old neglected cases, timidly treated by small incisions, the patient should be anesthetized, the incision enlarged to admit the finger for the breaking up of communicating pus sacs, etc., as already described. This is the only proper method; no half-way measures will succeed. In *sub-mammary cellulitis* the line of incision must be at the lower margin of the base of the gland following the circumference of the breast. Aspiration may be required, to detect pus early in these cases.

In badly managed cases, when acute symptoms have subsided, leaving the breast stiff, red, and unevenly indurated, with weeping fistulæ, paint with *tincture of iodine* and apply systematic compression with bandages or adhesive plaster, leaving apertures over the fistulæ for drainage.

In every case of considerable duration, good food, iron, quinine, and bitter tonics will be necessary to prevent debility and exhaustion.

The treatment of mammary *inflammation* with a view to *prevent suppuration* has always been unsettled, embracing many different and sometimes opposite methods. The main principles are: (1) *Rest, i. e.*, keeping the child from the inflamed breast; (2) systematic compression by well-padded bandages; (3) application of ice or of astringent and anodyne lotions; (4) reduction of milk by laxatives; (5) fever, pain, and other symptoms to be treated as they arise; (6) cure of sore nipples and *thorough antiseptic cleanliness*.

Finally, the employment of fld. ext. *phytolacca decandra* (poke root) in doses of twenty drops every three or four hours and applied to the inflamed breast locally, has been extolled as a specific; it is said to cure in twenty-four hours (?).

LACTATION AND WEANING.

No arbitrary rule can be laid down suitable for all cases, as to the length of time a woman should nurse her child. About one year is the average time at which weaning may take place. Many mothers nurse their children longer. With savages lactation is often continued several years, or until the advent of another child. With many delicate and sensitive women in the higher walks of life it is impossible to continue lactation beyond a few months, and many of those who persist in prolonged lactation beyond a year, suffer in consequence from anæmia, menorrhagia, and permanent impairment of their capacity for lactation, as is demonstrated when future children are born to them.

Besides a general incapacity for producing milk without exhaustion, there are certain conditions which should prohibit a mother from nursing her child. These are a strong hereditary tendency to cancer, scrofula, and insanity, constitutional syphilis, great emotional excitability. A violent fit of anger has rendered the lacteal secretion sufficiently poisonous to produce convulsions in the child. Lesser but more constant degrees of emotional excitement produce deterioration of the milk to an extent which may still be injurious.

The return of menstruation and the recurrence of pregnancy during lactation usually change the milk and make it unfit for the child. Exceptionally this is *not* the case. Some pregnant and menstruating women continue to secrete milk that agrees with the child. The health of the infant will indicate to which class the mother belongs.

When from any reason the woman is not able to nurse, the infant must either be fed by hand or supplied with a wet-nurse, the latter course being always preferable when it is practicable. In selecting a wet-nurse it should be ascertained that she is free from all of the impediments to lactation just referred to; that her digestion and appetite are good; that her disposition is cheerful and good-natured; that she is free from eruption on the skin; has sound gums and teeth and inoffensive breath; and that her own child is healthy and well nourished. Her breasts and nipples must be normal, and it should be known that fulness of the breasts has not been

artificially contrived by permitting milk to accumulate for many hours before the examination. The age of the wet-nurse, where there is room for choice in this particular, should be between twenty and twenty-eight years, and the time of her confinement as nearly as possible coincident with that of the mother whose child she is to nourish. When no wet-nurse can be procured, the child must be artificially fed by hand. Directions for the preparation of its food have been previously given in Chapter XIII. (page 278).

CHAPTER XXXVIII.

RESUSCITATION OF ASPHYXIATED CHILDREN.

CHILDREN born *dead* are said to be "*still-born*." Others are born in a state of suspended animation, apparently dead, not really so ; there is no breathing, but the heart still beats. It is asphyxia just within a fatal degree ; technically *asphyxia neonatorum*—the asphyxia of newborn children.

Causes.—*First*.—Conditions of *mother* interfering with respiratory functions of placenta, viz., death of the mother ; extensive pulmonary disease, restricting her own respiration ; profuse hemorrhage or profound anemia from other causes, which may leave her without sufficient red globules to carry on respiration, etc.

Second.—Conditions of *child* and its *appendages*, viz., compression and twisting of umbilical cord ; interference with placental circulation by its partial or complete separation before birth, as in placenta prævia, etc. ; prematurity of birth ; injury of child's head during delivery by compression of forceps, narrow pelvis, etc., possibly with intracranial hemorrhage, shock, and nervous disturbance, preventing action of inspiratory muscles after birth.

Symptoms.—*Before delivery* asphyxia should be anticipated when the above causes are known to have been present. Fœtal heart (by auscultation) found at *first* to beat with *diminished* frequency, not only during, but *between* the pains ; later on there is *increased* frequency of the heart-beats. *Discharge of meconium* is of great diagnostic import when *not* accounted for by compression of child's abdomen, as in breech presentations.

Discharge of meconium also indicates that breathing *in utero* has occurred, which makes the case worse from fluids having been drawn into air-passages. Occasionally air gets into womb, and child is heard to cry before birth (*vagitus uterinus*). When child's body is partly extruded, inspiratory efforts may be *seen*, as may also the lividity, etc., indicating asphyxia.

Symptoms *after birth* : The child is born in one of two con-

ditions ; it is either *livid* in color, with purple, dusky-red, and congested skin, dark and swollen lips, etc., constituting the earlier and milder form of asphyxia called *asphyxia livida*, or it is *pale*—of a corpse-like whiteness—with anemia of the skin, constituting the later and more fatal form of asphyxia called *asphyxia pallida*.

In the *livid* variety the vessels of the cord are full and turgid ; in the *pale* variety they are empty, or nearly so. In *livid* cases the limbs and muscles retain some tonicities, and reflex contractions may be excited by pinching and other stimuli ; in *pale* cases muscles are totally relaxed, including the sphincters, and reflex excitability is absent ; the lower jaw drops, the head dangles loosely. Pupils are widely dilated.

Prognosis.—Most of the *livid* cases may be resuscitated ; so may some of the *pallid* ones. While the heart beats there is hope ; it *may* beat when not felt to do so, and when all pulsation in the cord has gone. Exceptional cases have *undoubtedly* been resuscitated seven or eight *hours* after delivery ; most of these die, after a few days, from pulmonary extravasation, atelectasis, and pneumonia, but recoveries are known. Any child that is fresh, *i. e.*, not macerated, or presenting evidence of having been dead some considerable time, should be subjected to treatment ; it satisfies the parents.

Treatment.—In any case, whether *livid* or *pallid*, waste no time in making a diagnosis between life or death. Act as if the child were *alive*, but never hurry ; it is not a matter of moments, but may require a *full hour* before abandonment would be justifiable, even though the child may not have breathed during this time.

In *all* cases there are *two* things to do, *viz.* :

1. *Remove foreign matters from the air-passages.*
2. *Get air into the lungs.*

In the bad, *pallid* cases, it may be necessary *after* removing foreign matter and *before* air can be introduced, to

3. *Open the glottis.* (The muscles, whose duty it is to open the glottis, fail to act ; they participate in the general flaccidity of the muscles of the whole body, already noted.)

The methods of accomplishing these several objects are various.

1. **Methods of Removing Foreign Matters from the Air-passages.**—(*a*) Place the child on its back, the head a little

lower than the body, hanging over the edge of a table. Pass the little finger into the fauces and so wipe out *the mouth and pharynx* with a thin, soft handkerchief, or the child may be held by the feet, suspended head downward, while fluids flow out by gravitation.

(b) To clear out *the trachea*, place the child in same position, grasp the chest gently and continuously with one hand, and with a finger of the other stroke the trachea on the outside, from below upward, by which mucus is squeezed out of it into posterior nares. Let the finger now maintain pressure at the top of the trachea, and the other hand maintain its compression of the thorax while the obstetrician blows gently into the child's mouth, previously covered with a handkerchief. Mucus from the trachea is thus forced out at the child's nostrils.

(c) Pass a catheter into the trachea and aspirate or blow out mucus by application of operator's mouth to other end of it; or retain catheter in trachea while Schultze's method (mentioned further on) of artificial respiration is performed. To catheterize the trachea, select a gum-elastic male catheter, the diameter of the external circumference of which shall be less than one-eighth of an inch; fasten to it a string or tape, three and a half inches from the end to be introduced; guide its point with the finger behind the epiglottis and into the glottis, passing it in until the tape, three and a half inches from the end, touches the child's lips, when the point will remain above the bifurcation of the trachea. To retain catheter at this point, tie ends of tape around the back of the child's neck. Now compress thorax gently with one hand as before explained and blow through catheter. Since the air blown in cannot enter lung while thorax is compressed, it will rush back and up alongside of catheter and *carry mucus, etc., out of trachea* into pharynx. Suction of a catheter is a more unpleasant method, but not a better one.

2. Methods of Getting Air into the Lungs.—(a) The ordinary ways of exciting *natural inspiration* by sprinkling face, neck, and chest with cold water; rubbing the back or chest with brandy or whiskey on a bit of flannel; flagellate nates; dip the child first in hot, then in cold water; pull the navel-string downward by gentle jerks; eject a mouthful of cold water forcibly against the epigastrium.

(b) *Schultze's Method of Artificial Respiration.*—The cord must be cut and tied. The operator stands with his legs

FIG. 300.

FIG. 301.



Position of inspiration. (WITKOWSKI.) Position of expiration. (WITKOWSKI.)

apart, his body leaning a little forward, and holds the child at arm's length, hanging perpendicularly, in the following manner: He faces the child's back, puts an index finger into

each axilla, his thumbs over the shoulders so that their ends lap over the clavicles on to the front of the chest, the rest of his fingers go obliquely over the back of the chest, the ulnar sides of the two hands support the child's head. The *whole* weight of the child's body now *hangs on the index fingers* in the axillæ which lifts the ribs, expands the chest, and produces *inspiration* mechanically. (See Fig. 300, page 644.)

Inspiration having been thus accomplished, the second object of the operator is to produce mechanical *expiration*. This he does by swinging the child forward, somewhat powerfully, and at arm's length, until his arms are a little above a horizontal line, when, by a somewhat abrupt but carefully adjusted arrest of the motion, the thorax of the child becomes stationary, while the lower limbs and pelvis of the infant retain just enough of the swinging impetus to topple over toward the operator and in front of the child's abdomen (see Fig. 301). The bulk of the weight of the child now rests upon the thumbs in front of the thorax, while the abdominal viscera press against the diaphragm, etc., and produce *expiration*. At this stage of the proceeding any fluids that may have entered the trachea are copiously discharged.

Finally, the operator again lowers his arms, letting them retrace the curve followed during their elevation, by which the legs and pelvis of the infant unfold from their doubled position, and falling down at full length the body is completely extended with considerable impetus, so that the child again hangs by the axillæ on the index fingers of the operator, just as it was before the swinging motion began. The whole process of each complete act, comprising both the *inspiratory* and *expiratory* movements, should occupy about seven seconds; hence it may be repeated at the rate of eight or nine times a minute, *somewhat* as follows:

	Seconds.
Inspiratory pause, while body is supported by fingers in axillæ	2½
Upward swing	1
Expiratory pause, while thorax is supported on thumbs, and legs, etc., topple over	2½
Downward swing	1
Duration of one complete act	7

This chronological division of each act may vary. When inspired fluids flow out while the child is elevated, a longer pause in that position is advisable. Schultze's method may be used with or without catheter. Even without the catheter, and in the pallid cases with a closed glottis, it serves in some way to *open the glottis* which other methods do not.

Schultze's method must not be done *roughly*, especially in premature children; it has produced internal hemorrhages, rupture of the liver, and fractures of bones, when violently and carelessly executed.

(c) *Sylvester's Method of Artificial Respiration*.—Place child on its back, the shoulders resting on a little roll or cushion, just high enough to keep the chin from falling on the chest. Secure the feet to some fixed point. Stand behind the head; seize the arms (one in each hand) just above the elbows, and raise them gently and steadily upward and forward until they are fully extended along the sides of the child's head, at the same time rotate the humerus slightly outward; maintain the arms thus on the stretch for two or three seconds. This secures *inspiration*. Next turn down the child's arms and press them firmly and gently against the sides of the chest for two or three seconds. This secures *expiration*. It may be necessary to pull the tongue forward to open epiglottis, and this does not always succeed. Should there be difficulty in securing patency of the glottis, the only *sure* remedy is the catheter, used as before stated.

(d) *Laborde's Method by Tongue Traction*.—An assistant holds the child in a half-sitting position while the operator seizes the infant's tongue with the thumb and index finger and a piece of linen as near to the base as possible, and pulls it forcibly forward and then relaxes it, repeating the tractions about fifteen times a minute. Instead of the fingers a pair of dressing-forceps may be used. It is supposed to excite respiration by reflex action. This method is new, and still a matter of experiment. It can do no harm. Evidence of its value is increasing. It would seem to be especially applicable to premature children in which the thoracic walls are too soft and yielding for the Schultze and Sylvester methods, and in which inflation of the lungs through a catheter is commonly necessary. Williams speaks of it as "the most effective measure at our disposal, and the prognosis becomes extremely

gloomy if its employment is not attended by satisfactory results within a few minutes" ("Obstetrics," p. 751, first edition, 1904).

(e) *Method of Byrd and Dew*.—Let the child rest on its back in the hands, so that the back of its neck lies between the thumb and index finger of the left hand, while the other fingers of this hand go into the child's left axilla. Be sure that the head *dangles freely backward* and downward over the junction between the thumb and index finger, otherwise the glottis may not open. The right hand holds the child's thighs so that they rest in the palm, with the right index finger between them. Now the child's spine is alternately *extended* and *flexed*, which produces respectively *inspiration* and *expiration*. During *flexion* the knees and chin approach each other; during *extension* they are separated as far as possible. The body is thus folded and unfolded, doubled forward (knees and chin together), spine flexed, then stretched out backward as if it were suspended transversely on a trapeze, with the head and chest hanging on one side and the pelvis and legs upon the other, so that the spine is extended, the chest expanded, and air consequently inspired. This manipulation is repeated fifteen times a minute. There are several other methods of holding and folding the child in the practice of this Byrd-Dew method, equally effective and easy of execution. One advantage of this method is that it can be done while the child is in a basin of hot or cold water.

(f) *Buis's Method*.—Lay the child's body *across* the palm of one hand, face downward, with its feet toward the operator, so that the arms and head of the child hang by gravity over *one* border of the hand and its lower limbs over the *other*. Then roll it over quickly so that its back falls *across* the palm of the other hand. This motion is repeated to and fro, the child being almost tossed or flapped from one hand to the other. It is evident when the child's body thus hangs across the hand on its *back*, inspiration is produced; when it hangs face downward on its chest and abdomen, expiration occurs. The hands of the operator are held near together, so that the child is simply rolled from one to the other in the manner stated.

(g) *Marshall Hall's Method*.—Sit down, lay the child across your lap on its back, its head hanging over one thigh (say

the right one, for example), so that its left side is toward your body, its right toward your knees. Now take hold of its left arm (the one toward you) with your right hand and its left thigh with your left hand. Then roll the child over toward your knees until it rests on its right side, or a little beyond this, almost on its abdomen. This compresses the chest, producing *expiration*. Then roll the child back into its original position, traction on its left arm being made forward and upward toward its head. This causes expansion of the chest and *inspiration*. Repeat about ten times a minute.

When asphyxia is recognized *before delivery*, labor must be expedited by every available judicious means.

Schultze's method, while a rough proceeding, and requiring some skill, is *necessary*, at *first*, for the *pallid* cases, but may be followed by *Sylvester's* when the pallid stage is passed. For most *livid* cases the easier and gentler method of Sylvester, Marshall Hall, or Buist may suffice.

In cases where the heart scarcely beats, its contractions may be stimulated by making slight pressure with the fingers over the precordial region, by injecting hot water (105° – 108° F.) into the rectum, or by a few drops of brandy or whiskey injected hypodermatically.

Children that have been deeply asphyxiated require, even after complete resuscitation, *extra warmth*, and in case of subsequent heart-failure—always liable to occur—a drop of tincture of digitalis and 3 or 4 drops of brandy, internally, repeated every few hours, or as often as may be necessary. A good many will die within a day or two, even with the most watchful care and attention.

CHAPTER XXXIX.

THE JURISPRUDENCE OF MIDWIFERY.

AN obstetrician, even when not an acknowledged expert in medico-legal matters, may, from his professional relations with patients or persons implicated in legal trials, be compelled on the witness stand to give evidence of a scientific or *quasi*-expert character. Under such circumstances a painful lack of scientific knowledge, often sufficient to defeat the ends of justice, and coupled with corresponding embarrassment on the part of the physician, is not infrequently exhibited in our courts. Hence I have ventured to add, in so far as may comport with the brevity of this work, a few rudimentary remarks upon medico-legal topics of an obstetrical character, which while treating the subject only superficially, may perhaps afford some assistance to the unavowed expert or confessed *un-expert* medical witness. The works on *Medical Jurisprudence* by Alfred Swaine Taylor and by Theodric R. and John B. Beck are my principal sources of information for what is to follow.

Duration and Unusual Prolongation of Pregnancy.—The average duration of pregnancy is *ten* lunar months (forty weeks—280 days). The moral character of a woman and the legitimacy and consequent hereditary rights of offspring may depend upon the acknowledged degree to which it is *possible* this normal duration may be prolonged, as when a woman gives birth to a child eleven or twelve months after the death (or continued absence from other cause) of her husband. It is undoubtedly *possible* for pregnancy to be prolonged four, five, six, seven, or even eight weeks beyond the normal period, and the child be born alive.¹ Cases are re-

¹ A child may die near full term (after symptoms of labor have begun and disappeared), and remain *in utero* months and years afterward—so-called “missed labor” cases.

recorded in Taylor's *Medical Jurisprudence*, 5th Amer. ed., pp. 473-481; Playfair's *Midwifery*, 2nd Amer. ed., pp. 154, 155; Lusk's *Midwifery*, 1st ed., pp. 109, 110; Leishman's *Midwifery*, 2d Amer. ed., pp. 178-181; Meigs' *Treatise on Obstetrics*, 3d ed., pp. 228-234; Beck's *Jurisprudence*, 11th ed., vol. i., pp. 600-604.

Those who assert such cases to be fabulous and unreliable may be answered with the statement that the same amount of prolongation has been observed in animals (cows and mares) in which the date of coitus was *positively known*.

The possible unlimited retention of the child in certain cases of extra-uterine gestation must be remembered in relation with the duration of pregnancy, in so far as it may affect the character of the woman. The child, after full term in such cases, always dies.

Children born after over-long pregnancies may be overlarge, but are not always so.

The Age of Maternity.—Social laws in most places restrict very early maternity, but in Oriental countries where marriage is permitted earlier, girls become mothers at ten or twelve years of age. Such cases occur, rarely, in other climates. Three cases, one at eleven years, one at twelve, and one at thirteen, well authenticated, are recorded in Barnes' *System of Obstetric Medicine and Surgery* (1st Amer. ed., p. 241), in Great Britain. In one case the girl began to menstruate while a child twelve months old, and also had enlarged breasts, with growth of hair upon the pubes and in the axillæ. She was delivered of a child weighing seven pounds before she was ten years old. (London *Lancet*, 1881.)

As to the *latest* age at which a woman may bear a child, a few cases have been recorded at the age of fifty-one and fifty-two years (by Fordyce Barker in Philadelphia *Medical Times*, 1874), and one at the age of fifty-five years by Davies, of Hertford, England (London *Medical Gazette*, vol. xxxix.). Barker declares that "the laws of physiology, the experience of mankind, and the decisions of courts of law justify a medical man in declaring that a woman *over fifty-five years* of age is past the period of childbearing."

Though it is rare for women to bear children after the cessation of the menses at the "change of life," it is *possible* for them to do so, as rare cases occasionally demonstrate.

Short Pregnancies with Living Children.—A living child, and one that continues to live, being born nine, eight, seven, six, or five lunar months after marriage, may be the cause of suspected pre-marital in chastity on the part of the mother, and possibly of alleged ground of divorce by the husband, together with other legal and social complications. The child is undoubtedly viable at the end of the seventh lunar month. Exceptionally, children born at the sixth month have lived and been *reared*. Cases are even recorded where the infant survived a *short time* when born at the fifth, or even at the fourth month. (See Playfair's *Midwifery*, 2d Amer. ed., p. 229; Beck's *Medical Jurisprudence*, 11th ed., vol. i., pp. 599, 600, also p. 338; Meadows' *Manual of Midwifery*, 4th Amer. ed., pp. 93, 94; Taylor's *Medical Jurisprudence*, 5th Amer. ed., pp. 468–471.) The *possibility* of exceptional cases must always be remembered and stated. It should, moreover, be borne in mind that an error of a month may occur, depending upon the selected method of dating the *beginning* of the pregnancy, *i. e.*, whether from the last menstruation or from the first *omitted* menstruation (see page 68).

External Appearances of Fœtus at Different Periods of Gestation.—A medical witness may be asked to express an opinion as to the *probable* duration of a given pregnancy, from the appearance of the child. He cannot be *positive* or exact.

During First Lunar Month.—Only a few human embryos have been observed during the first two weeks. During the second fortnight the *body* of the embryo is very small, but with a very large umbilical vesicle. During the third week the body is curved antero-posteriorly, the dorsal surface presenting a deep concavity, so that the spine (or what is to become the spine) resembles an imperfect letter S. During fourth week this concavity is reversed; the little body is flexed forward, head and tail almost touching each other like the letter C. Toward the end of the month small budding projections indicate rudimentary limbs. When the month is complete the body measures 7.5 to 10 mm. (0.3 to 0.4 in.) in length.

Second Month.—Umbilical vesicle diminishes in size. Head enlarges; tail disappears. Visceral clefts and arches appear. Fœtus presents a recognizable human form. Em-

bryonic body, at end of month about one inch (2.5 cm.) in length. The entire blastodermic vesicle is about the size of a pigeon's egg. Traces of external genitals perceptible.

Third Month.—By the end of the month the entire blastodermic vesicle has grown to the size of a goose's egg. The embryonic body is 8 or 9 cm. (about 3 to 3½ in.) long. Sex is perceptible; also eyelids, fingers, toes, and traces of nails. The umbilical vesicle atrophies.

Fourth Month.—Body grows from 3½ to 5½ or 6 inches in length (9 to 16 or 17 cm.) by end of month. Weight 3 to 6 ounces. Sex well defined. Lanugo appears. Skull bones present commencing centres of ossification.

Fifth Month.—By end of month body 9 or 10 inches (26 cm.) long.¹ Weight 8 ounces. Head one-third the length of whole fetus. Downy covering of lanugo over the whole body, perhaps a few typical hairs on the scalp.

Sixth Month.—Skin wrinkled as if body emaciated, presenting an "old age" appearance. Length of body, at end of month, 10, 12, or 13 inches. Weight from 1½ to 2 pounds. Vernix caseosa apparent. Lanugo shedding. Eyelids separated. Eyebrows and eye-lashes appear. Testicles still in abdomen. A child born at this age may move and attempt to breathe but usually soon dies.

Seventh Month.—Length 14 inches (35 cm.); weight 3 or 4 pounds. Testicles descend into scrotum. Pupillary membrane disappears. Nails well formed. When born at end of month, child breathes, moves, and cries feebly; with care it may survive; it has reached the age of viability. The popular idea that a child born at the seventh month is more likely to live than one born at the eighth, is an error; no truth in it.

Eighth Month.—Skin red and still wrinkled, like old age in appearance. Nails reach to ends of fingers. Length about 16 inches (40 cm.). Weight 4 to 4½ pounds.

Ninth Month.—Length 18 inches (46 cm.). Weight 4½ to 5½ pounds at end of month. Owing to increase of subcutaneous fat the child loses its wrinkled, aged appearance.

Tenth Month.—Length at end of month (full term) 20

¹ For this, and the succeeding months, allowing two inches for each month will give a rough approximate average of the child's length: 6th, 12; 7th, 14, etc.

inches, about 50 cm. Average weight 7 pounds. May be only 6, or even less; and once in about 1000 cases may reach 12 or 13 pounds. Meconium found in rectum, urine in bladder. Nails project a little beyond finger-tips.

Cases in which a Woman May be Unjustly Suspected of Conjugal Infidelity.—Delivery of a mature or premature child having taken place, the woman (without having meanwhile seen her husband, and without having again submitted to coitus) may, in the course of one, two, or three months be delivered of another child, which may be either mature or premature. Such cases are susceptible of explanation in three ways:

First.—In twin pregnancies one child may be expelled and the other follow only after several weeks or months. (For cases, see Taylor's *Medical Jurisprudence*, pp. 486–489; Ramsbotham's *Obstetrics*, p. 468; Leishman's *Midwifery*, p. 193; Churchill's *Midwifery*, American edition, 1866, pp. 177, 178, etc.)

Second.—The woman may have a double (bi-lobed) uterus, in each side of which is a fœtus, the two uterine cavities expelling their contents at different times. (For cases, see Playfair's *Midwifery*, pp. 58 and 161; Leishman's *Midwifery*, pp. 188, 189; Taylor's *Jurisprudence*, p. 488; Churchill's *Midwifery*, p. 178.)

Third.—A pregnant woman submitting to coitus during the early months of gestation may have a second ovule impregnated (super-fœtation), perhaps, just prior to the subsequent death or departure of her husband. The two fœtuses may be born at different times. (For cases, see Taylor's *Jurisprudence*, p. 487; Leishman's *Midwifery*, pp. 186–188; Playfair's *Midwifery*, pp. 161, 162; Churchill's *Midwifery*, pp. 178, 178.) The occurrence of super-fœtation has been questioned, but its possibility, and its actual occurrence as a matter of fact, are now generally admitted.

When the two children are of different race or color, one white, the other black ("super-fecundation") the fidelity of the female may be justly questioned.

Finally, a woman may expel a child from the uterus in the usual way, and still remain pregnant, even for years afterward, owing to the retained fœtus of a coexisting extra-uterine pregnancy.

True and False Moles.—The diagnosis of bodies expelled from the genital canal, not due to impregnation, from those necessarily the result of coitus has been already sufficiently considered. (See “Hydatidiform Pregnancies,” p. 218, and “Moles” p. 223.)

Diagnosis of Pregnancy.— (See pp. 140–143.)

Signs of Recent Abortion in the Living.—When the fœtus and its membranes, in a case of suspected abortion, are concealed, a medical witness may be required to give evidence as to existing signs of recent abortion in the female. Abortion during the first three months of pregnancy may, even so soon as twenty-four hours after delivery, leave *no proofs whatever* of its occurrence in the living woman that can be recognized by examination.

The ordinary signs, at best ambiguous, viz., dilatation of the os uteri, with some lochial (bloody) discharge therefrom, enlargement of the uterus, swelling and relaxation of the vulva and vaginal orifice, enlargement of the breasts, secretion of milk, presence of darkened areola around the nipple, etc., may either be wanting, or on the other hand, result from other causes.

Signs of Recent Abortion in the Dead.—Even the *post-mortem* signs of abortion during the first three months of pregnancy may so completely disappear in the course of a few days after delivery as to leave no positive evidence. Satisfactory proofs may, however, be obtained, if examination be made within forty-eight hours after expulsion of the ovum. Then we find usually some enlargement of the uterus, both of its cavity and walls, the latter being thicker and with larger bloodvessels than in a *normal* and unimpregnated state. Cavity of womb may (?) contain remnants of blood-clots, membranes, or placenta. The internal aspect of the uterus may exhibit, after and during latter part of third month, the placental site—a darkened and rough surface. Fallopian tubes and ovaries of deep color from physiological congestion of pregnancy. True corpus luteum in ovary. *Caution*: Even these evidences of early abortion, however soon after delivery, can scarcely be more than *presumptive*. Menstruation and uterine diseases require to be excluded (often very difficult) before certainty can be attained. The value of the corpus luteum is considered more at length on page 656.

Signs of Recent Delivery during Later Months and at Full Term in the Living and in the Dead.—Symptoms in the *living* are: Woman more or less weak and incapable of exertion. (Exceptions possible, especially with women in lower walks of life, and among negresses, Indians, and savages. For cases, see Beck, vol. i., pp. 376, 377.) Slight pallor of face; eyes a little sunken and surrounded by darkened rings, and a whiteness of skin resembling convalescence from disease. The above symptoms often absent after three or four days. Abdomen soft; its skin relaxed, lying in folds, and traversed by whitish shining lines (*lineæ albicantes*), especially extending from the groin and pubes to navel. (Exceptions: these *may* be the result of dropsy, tumors, or a former pregnancy.) Breasts, after the first day or two, full, tumid, and secreting milk. (Exceptions: some women secrete no milk after delivery.) Milk may be, or may be alleged to be, result of a previous pregnancy (before the one in question). Detection of colostrum corpuscles in milk shows delivery to be recent. Nipples present characteristic areola, especially “secondary areola,” outside the disk. External genitals relaxed and tumefied from passage of child. Uterine globe felt in hypogastric region through walls of abdomen. Os uteri swollen and dilated sufficiently to admit two or more fingers. Lochial discharge: its color varying with interval since delivery; may be distinguished from menses and from leucorrhœa by its characteristic odor, sometimes described as resembling that of “fish oil.” Absence, by laceration, of fourchette; but this is persistent after one labor. Os uteri fissured by radiating shallow lacerations or resulting cicatrices; the latter being, of course, permanent. All these signs *may* be wanting, or become so indistinct in a week or ten days after delivery as to be unreliable. In other cases they are available for two or even three weeks. Examine as early as possible in all cases.

Signs in the Dead.—These may be available two or three weeks after delivery. Not reliable later.

They are enlargement, thickening, and softer consistency of the uterus. During *first day or two*, womb will be found seven or eight inches long and four broad; ¹ its walls one or

¹ When, however, death has occurred from hemorrhage, and there is *no contraction* of the uterus, the organ will be found as a large flattened pouch, measuring ten or twelve inches in length.

one and a half inches thick, section presenting orifices of enlarged bloodvessels. After *one week*, following a full-term labor, womb between five and six inches long (about the "size of two fists"); after *two weeks*, five inches; at *a month* the organ may have contracted to its unimpregnated size. *Uterine cavity* during first day or two, and perhaps later, contains bloody fluid or coagula of blood, and pulpy remains of decidua. Placental site presents valvular, semilunar-shaped vascular openings and looks dark, somewhat resembling gangrene in appearance. Fallopian tubes, round ligaments, and ovaries purple from congestion. Spot where ovum escaped from the ovary especially vascular. Orbicular muscular fibres around internal opening of Fallopian tubes distinctly visible for one or two weeks. All the above signs become less marked as interval since labor increases. *Ovary* presents true corpus luteum; value of evidence furnished by it variously estimated by authorities. Chief characteristics of "*true*" corpus luteum (the corpus luteum of *pregnancy*) are its large *size*, long *duration*, its being usually *single*, and its having a distinct *cavity*, either empty or filled with coagulated blood, which is either substituted or followed by a stellate, radiating, puckered *cicatrix*. Cavity as large as a pea; may remain three or four months after conception. Ovary is enlarged and *prominent* at the site of true corpus luteum. True corpus luteum varies greatly in size and duration in different women. During the first three months its average size is nearly one inch long by half an inch broad, and during remaining months of entire pregnancy it measures *about* half an inch long and a little less in width. Getting smaller toward the end of pregnancy, it still remains one-third of an inch in diameter for some days after parturition, and presents a sort of hardened tubercle even a month or more later. *False* corpus luteum (that following menstruation) grows only three weeks, when it measures about half an inch by three-quarters, and then retracts, becoming an insignificant cicatrix by the seventh or eighth week. It is not *prominent*, has no *cavity*, no *radiating cicatrix*, and is associated with *others* like itself, perhaps in both ovaries.

Evidence of pregnancy derived from corpus luteum is *corroborative* of other signs only; taken by itself it cannot furnish *positive* proof either way, owing to liability to exceptional

variations in its development. It certainly cannot prove *child-birth*, for after impregnation, fœtus may have been absorbed and ovum may have degenerated into hydatidiform mole.

Unconscious Delivery.—It is easy to imagine criminal cases (*ex. gr.*, infanticide) in which a plea of unconscious delivery might be set up. Medical testimony would, in such instances, be required as to the possibility of its occurrence in general, and also as to the likelihood of its having taken place in any given case. Women have undoubtedly been delivered unconsciously during sleep and syncope; during the coma of apoplexy, puerperal eclampsia, asphyxia, typhus and other malignant fevers; also while under the influence of narcotic poisons and anæsthetics, as well as after death. Others have been delivered while at stool, mistaking their sensations for those of defecation (?).

Delivery during *ordinary* sleep is very improbable in primiparæ or in women with small pelves; less so in those with over-large pelves. Examine circumstantial evidence and insist on full statement of facts from woman herself before admitting unconscious delivery in any particular case. Its possibility, however, is undoubted. (For cases, see Taylor's *Medical Jurisprudence*, pp. 417-419; Beck's *Medical Jurisprudence*, pp. 371-373.)

Feigned Delivery.—Delivery has been feigned for the purpose of extorting charity, compelling marriage, producing an heir, or disinheriting others, etc. When the woman has (admittedly) *never been pregnant before*, her fraudulent pretensions may be detected (usually, and especially if a *recent* delivery be claimed) by finding breasts unenlarged and presenting no appearance of milk secretion or characteristic areola; no lineæ albicantes upon the abdomen; no enlargement or irregularity of the os uteri; no discharge from vagina; a firm, solid, well-contracted, small, and easily movable womb. Compare alleged date of delivery with appearance of child alleged to have been delivered, noting skin, vernix caseosa, umbilical cord, size, hair, etc., of the latter. (For cases, see Beck's *Medical Jurisprudence*, pp. 342-355.)

When a pretended delivery has been *preceded by others* (one or more) detection is more difficult. Signs of recent delivery may or may not be present. Examine for them. Inquire into any mystery or concealment respecting situation of female

before alleged delivery, during alleged pregnancy; also as to her age and fertility, or previous prolonged sterility; also as to age, decrepitude, or impotency of the alleged father.

Criminal Abortion—Fœticide.—A medical witness may be required to state the *natural* causes of abortion in general, and also his opinion, in particular, as to whether alleged (or proved) existing natural causes did, could, or were likely to produce it in a given case. Such evidence may be necessary to eliminate *natural* from *criminal* causes, as for example, when a female, having aborted spontaneously, attempts to fix the crime on an innocent person, and in other cases. The *natural* causes—certain fevers, acute inflammation, syphilis, violent mental emotion, etc.—have already been mentioned. (See “Causes of Abortion,” p 190.) An opinion as to the efficacy of one or more of them in a given case must depend (1) upon their intensity, location (of inflammation), virulence, and malignity (of fever), etc., and (2) upon the nervous irritability or susceptibility—in fact, *predisposition* to abort—on the part of the patient, especially as to history of previous abortions, and the “abortion habit.”

Medical evidence may be required also as to *accidental* causes in general, and their probable efficacy in given cases. Such causes are blows, falls, jarring the body by railroad and street-car accidents, joggling over rough pavements in vehicles, horseback exercise, etc. After blows upon the abdomen, the uterus, as well as the child, may or may not present evidences of contusion, laceration, incision, etc. Examine for them. Bones of child have even been broken and reunited *in utero*. As to the efficacy of accidental causes, the influence of *predisposition* to abort is paramount. Women have been subjected to repeated and prolonged mechanical violence without aborting, when *no predisposition* existed. Books teem with cases. (For remarkable ones, see Beck's *Jurisprudence*, pp. 490, 491.) On the other hand, women *with* predisposition abort after very slight causes. Predisposition indicated by great emotional excitability, nervous habit, sensitiveness and anæmia, by plethora, with (previous habitual) profuse menstruation, by previous existence of other constitutional diseases acting as spontaneous causes of abortion, and by existence of the “abortion habit.”

Medical Testimony as to Medicinal Abortives and Instrumental Methods.—Medical witnesses should neglect no opportunity of stating (what are actual facts, viz.) that all these methods are (1) *uncertain* in their operation upon the child; (2) always dangerous and often fatal to the mother; and (3) sometimes fatal to mother without affecting infant. Children have survived and lived after the mother's death where premature delivery had been induced by criminal means.

Emetics.—Emetics have been given in large doses, and induced violent vomiting without producing abortion. The spasmodic contractions of the abdominal walls and diaphragm accompanying emesis are more dangerous in proportion to greater size and development of uterus; hence during later months. Fifteen grains of tartar emetic have been taken without interrupting pregnancy (Beck, vol. i., p. 475).

Cathartics.—Purging carried too far, continued too long, and when accompanied with tenesmus, as after administration of decided *drastics*, may produce abortion, especially during later months. Cathartics may be given during early months, especially when no *predisposition* exists, without decided effect. Pregnant women attacked with disease may be purged freely without abortion. (Cases: Beck, vol. i., pp. 475, 476.)

Diuretics.—A drachm of powdered *cantharides* (in one case) and 100 drops of oil of juniper every morning for twenty days (in another), have been taken to produce abortion (Beck, vol. ii., pp. 477, 478), but in both instances living children were born at full term. Cantharides however, has induced miscarriages in some cases (Beck, vol. i., p. 478). These and such other diuretics as broom, nitre, fern, etc., exert no specific action on the uterus, and they, together with mineral and *irritant poisons*, such as arsenic, corrosive sublimate, sulphate of copper, etc., can only be considered abortives when they occasion shock or produce sufficient irritation or inflammation to affect the general system, often at the expense of the woman's life.

Juniperus Sabina.—This is a popular abortive of undoubted efficacy in some cases from the consequent irritation or inflammation it induces. It probably has no direct action upon the uterus. It has produced death and has been taken for criminal purposes in sufficient doses to produce severe gastritis without abortion following. Physicians administering it to

women suspected of pregnancy, or without being previously satisfied that pregnancy does not exist, would be fairly open to suspicion of criminality.

Secale Cornutum.—In trials for criminal abortion a medical witness must be prepared for a close examination on the specific emmenagogue properties of this drug (Taylor). Despite differences of opinion on this subject, the latest conclusion, and which seems inevitable, is that this medicine has a specific action as a direct uterine excitant, even when the uterus is not already in active contraction. Formerly it was supposed to act only when uterine contractions had already begun. Large doses have, however, been taken to produce abortion without effect (see Beck, vol. i., p. 483). Its emmenagogue properties increase as pregnancy advances and are probably more marked at periods corresponding with the former catamenia. (For numerous references and cases, etc., see Taylor's *Jurisprudence*, pp. 433-435, and Beck, vol. i., pp. 482, 483.)

Tanacetum Vulgare.—This has acquired popularity as an abortive. It possesses no specific action upon the uterus. The oil in doses of one drachm, four drachms, and eleven drachms was taken respectively in three cases, each of the women dying in a few hours without abortion coming on (Taylor, pp. 436, 437).

Hedeoma Pulegioides and Polygala Seneka.—These are reputed abortives, but of doubtful efficacy. The former is a decided emmenagogue. One case of abortion from its *odor* (?) is reported (Beck, vol. i., p. 481), but I find none due to seneka.

Mercury.—Crude quicksilver (even in quantities of a pound at once) and medicinal preparations of mercury, continued even until salivation, have been given without producing abortion. Ptyalism from mercury may, however, produce it in those *predisposed*.

Bloodletting.—Bleeding, leeching, and cupping were formerly considered abortives, but there is abundant evidence to the contrary.

Instrumental Methods.—The reader is already familiar with the methods of inducing labor for beneficent purposes, elsewhere considered. Devices somewhat akin to them are resorted to for criminal purposes. In such cases examine

carefully (1) the kind and extent of injury, if any, inflicted upon the uterus (especially the os and cervix) and the child; (2) note by what sort of instrument such injury could have been inflicted; (3) whether it could have been done by the woman herself or implied the interference or assistance of some other person; and (4) whether it indicated anatomical knowledge or a want of it on the part of the operator. Instruments *may* be introduced into uterine cavity repeatedly during the first three months of pregnancy without disturbing amniotic sac or discharging liquor amnii, and gestation still continue. After rupture of amnion, uterus begins to act in ten, twenty, forty, or sixty hours; sometimes not for a week. When contents of uterus are submitted for inspection, be certain whether or not they contain a fœtus, mole, or hydatidiform mass. Diagnose ovum in early cases by seeing villi of chorion under microscope, if no fœtus be present. If there be a fœtus, ascertain its probable age (see pp. 651–653). As to period at which a child *in utero* becomes alive or “quickens,” be ready to state that *it is a living being from the time of conception*—as much so at any time during the first month as during the last. The idea of life being imparted to it in any given period during pregnancy is an error long ago discarded.

Child Murder after Birth (Infanticide).—When a mother is suspected of killing her own child, medical testimony is necessary as to (1) whether she had been delivered of a child; (2) whether signs of delivery agree, as to time, etc., with appearances of child as to maturity, and length of survival after birth. (For signs of delivery, see page 655, and for signs of maturity, page 652.)

Inspection of Child's Body.—Original notes (made on the spot) to be kept as to the following points:

1. Exact length and weight of body.
2. Peculiar marks or deformities about it.
3. Marks of violence and probable mode of their production.
4. Umbilical cord: whether cut, tied, or torn; its length, and appearance of its divided bloodvessels.
5. Vernix caseosa on groins, axillæ, etc., as indications of washing and other attentions.
6. Odor, color of, and separation of cuticle from skin, as evidence of putrefaction.

Duration of Survival after Birth.—Signs uncertain, but great precision not demanded of medical witness. Length of survival for shorter time than twenty-four hours not to be determined by *any* sign. Drying, etc., of navel-string *may* occur in the *dead*. Usual appearances are during—

Second Twenty-four Hours.—Skin less red than during first day. Meconium discharged, but large intestine still contains green-colored mucus. Amount of lung-inflation unreliable, though perfect inflation *indicates* many hours of life. Cord somewhat shrivelled, but still soft and bluish-colored from ligature to skin.

Third Twenty-four Hours.—Skin tinged yellowish, cuticle somewhat cracked, preparatory to desquamation. Cord brown and drying.

Fourth Twenty-four Hours.—Skin more yellow; desquamation of cuticle from chest and abdomen. Cord brownish-red, semi-transparent, flat and twisted. Skin in contact with it red. Colon free from green mucus.

Fifth and Sixth Twenty-four Hours.—Cuticle desquamating in various parts in small scales or fine powder. Cord separates fifth day, but may not do so till eighth or tenth. Ductus arteriosus contracted; foramen ovale partly closed.

Sixth to Twelfth Day.—Cuticle separating from limbs. If cord was small, umbilicus cicatrized by tenth day; may not be healed completely till three or four weeks; much depends on the mode in which it has been dressed. Body heavier. Ductus arteriosus entirely closed; exceptions quite possible.

Was the Child Born Alive?—This question involves several upon which medical testimony may be required, viz.: 1. Did child *live* (as indicated by pulse, etc.), but *without breathing*? Children may so live for a short period (during which violence may be used), but there are no satisfactory post-mortem medical data to enable a witness to express a positive opinion on this point. Absence of respiration does not prove child to have been born dead, for it may have been drowned (in a bath) or suffocated intentionally at the moment of birth. Marks of violence *may* afford *uncertain* proof. Marks of putrefaction *in utero* prove death before birth; they are chiefly, flaccidity of body, so that it easily flattens by its own weight; skin reddish-brown, not green; that covering hands and feet is white, with cuticle sometimes raised in

blisters containing reddish serum. Bones movable and readily separated from soft parts. These appearances occur after child has remained *déad in utero* eight or ten days; scarcely available sooner. Note that the skin may become greenish when body is long exposed to air. 2. Did child *breathe as well as live?* (3) If so, did it breathe perfectly or *imperfectly?* Evidences of child having breathed are:

1. *The Static Test.*—The absolute or *actual* weight of the lungs is increased after respiration, owing to greater quantity of blood they contain. Hence 1000 grains have been proposed for average weight of lungs *after* respiration and 600 grains *before* respiration. Actual weight of child and of its organs varies so much in different individuals as to render this test totally *unreliable*. A second method of its application (Ploucquet's test) is to take the *relative* weight of the lungs as compared with that of the body, before and after respiration. Different observers have obtained the following *average* results:

	Before respiration.		After respiration.	
	Lungs.	Body.	Lungs.	Body.
Ploucquet	1	to 70	1	to 35
Schmitt	1	to 52	1	to 42
Chaussier	1	to 49	1	to 39
Devergie	1	to 60	1	to 45
Beck	1	to 47	1	to 40

Hence this test is certainly not infallible, but may furnish *corroborative* proof.

2. *The Hydrostatic Test (Specific Gravity of Lungs).*—Its general principle is that *before* respiration the lungs *sink* rapidly when placed in water, *after* respiration they *float* high in that fluid. They may, however, float from other causes, viz., from gases developed in them during putrefaction, from artificial inflation, and from emphysema. In these cases the contained air (or gas) can be forced out of the lungs by compression (to be applied as described below), so that they afterward sink; this cannot be done after *perfect* respiration. Artificial inflation does *not* increase weight of lungs. After *imperfect* respiration (as in feeble children, or those who take only a few gasps) the air *can* be expelled by compression, so that this is not to be distinguished from artificial inflation.

Exceptionally, the lungs may sink after respiration, from congestion, inflammation, and other diseases having increased their weight. Incising the lung and squeezing out its extra blood or cutting it up and compressing each piece will generally cause the organ, or some pieces of it, to float, if the child have breathed.

Application of Hydrostatic Test.—Having opened chest, note position of lungs before respiration they occupy a small space at upper and posterior parts of thorax; their volume (of course increased after breathing); their shape (before respiration, borders sharp or pointed; after it, rounded); their color (before breathing, brownish-red; after it, pale red or pink; their appearance as regards disease and putrefaction; and whether they crepitate on pressure (as they will after respiration).

Take out lungs with heart attached, and place them in pure water having temperature of surrounding air. Note whether they float (high or low), or sink (slowly or rapidly). Separate them from the heart and weigh them accurately; then place them in water again, and note sinking or floating, as before. Subject each lung to pressure with the hand, and note sinking or floating again. Cut each lung in pieces and test floating again. Take out each piece, wrap it in a cloth, and compress with fingers as hard as possible, and test floating, etc., as before. The crucial test of perfect respiration is each piece floating after the most vigorous compression.

Value of Respiration as Evidence of Live Birth.—Respiration does not prove child to have been born alive, for it may have breathed (imperfectly at least), and even have been heard to cry in the vagina or uterus¹ before birth was complete, as in face cases and retained head in breech presentations, etc. Exceptionally a child may live and even breathe (by bronchial respiration only) for hours and even days with partial, and twenty-four hours with actually complete absence of air from the lungs. (Cases: see Taylor, pp. 335-337; Beck, vol. i., p. 517.) The lungs retain their foetal condition of atelectasis. That they are not hepatized is proved by their

¹ It is said that a child has been heard to cry *in utero* weeks before delivery (Taylor, pp. 350, 351; Beck, vol. i., pp. 537, 538). On this point one feels disposed to adopt the remark of La Fontaine and Velpeau: "Since learned and credible men have heard it, I will believe it; but I should not believe it if I heard it myself."

susceptibility to artificial inflation. Physiological explanation of life under such circumstances still wanting. Probably *complete* absence of air is only apparent instead of real, owing to our means of demonstration being imperfect. Here the hydrostatic test is inapplicable, but this fact does not lessen its value in proving signs of respiration that *do* exist in other cases.

Evidence of Life from Circulatory Organs.—The contracted or open condition of the foramen ovale, ductus arteriosus, and ductus venosus furnishes no reliable evidence of live birth.

Evidence from Stomach.—The presence of farinaceous or other food in the stomach proves the child to have lived after delivery was complete, at least in the absence of any proof that food was placed in the stomach after death.

Natural Causes of Death in Newborn Children.—These, of course, have a direct bearing upon infanticide, and are: Prematurity of birth, congenital disease or malformation, protracted or difficult delivery, compression of umbilical cord, hemorrhage from the cord or umbilicus. (See pages 281, 326, 566.)

Violent Causes of Death in Newborn Children.—These may be either *accidental* or *criminal*. Death, however, may occur without any *marks* of violence, as from cold, starvation, suffocation, and drowning. In so far as these latter are concerned, an obstetrician may be required to testify as to the newly delivered female having sufficient strength, knowledge, sanity, and presence of mind to take proper care of her child, and prevent those occurrences. In a primipara, when delivered alone, the lack of these conditions may exonerate her from intentional guilt, as when the infant has been proved to have died by resting on its face in a pool of blood, or some other discharge; or when it has been delivered into a vessel containing water, on which the woman was seated, while mistaking her symptoms for those of defecation, etc. The opinion of an obstetrician in these cases, however, must be very guarded, especially with reference to single women and those delivered of illegitimate children. The circumstances attending delivery should first be accurately known, or at least diligently inquired into. The same caution is necessary in death *with* marks of violence, as in fractures of the skull, alleged to have occurred by the child falling during sudden delivery

in the erect posture, or by innocent attempts at self-delivery, or attempts made by a midwife or other person. Marks of strangulation around the neck may be mistaken for those due to coiling of the navel-string round the same part, and *vice versa*. In death from coiling of the cord, there are no deep marks on, extravasation of blood beneath, nor ruffling or laceration of the skin, nor injury of the deep-seated parts, as there usually are in homicidal strangulation. In strangled children the lungs have usually been inflated by respiration. In death from coiled cord they retain their fetal condition. Marks on the neck may, possibly, be made by forcible efforts at self-delivery, or by *cap-strings*,¹ or by bending of the head forcibly toward the neck soon after death, or as an accident of labor. These must be distinguished from homicidal marks. Pale, shallow marks *may* be made by coiling of the navel-string, but they are not accompanied with extravasation etc.

Fractures of the skull from the use of instruments during labor, even from force of uterus without instruments, and from falling of the child when the mother is suddenly delivered while erect, or while sitting in a water-closet, etc., can scarcely be distinguished from fractures or other injury due to criminal violence, except by circumstantial evidence, or by comparing size of child with pelvis in certain cases. The existence or non-existence of puerperal insanity (mania) is an important question in these cases.

Medical Evidence of Rape.—Medical evidence in rape is usually only corroborative of circumstantial proof, but may become leading testimony in cases of false accusation, or of brutal attempts upon infants and children.

Medical witnesses before expressing an opinion as to whether rape have been perpetrated, should first understand the legal definition of rape, as to whether it mean contact, vulvar penetration, vaginal penetration, emission, rupture of the hymen, etc., one or more. The rule laid down in the United States is that "there must be *some* entrance proved of the male within the female organ." That is enough. No matter about emission, etc.

Marks of Violence upon the Genitals.—These are ecchymosis, contusion, and laceration of the parts, with or without

¹ These, however, have been used for homicidal strangulation.

bleeding. Redness, tenderness, heat, and swelling from subsequent inflammation. *All* of these *may* disappear in two or three days after the act. In young children laceration of the perineum and of the vaginal wall, and penetration of the abdominal cavity with fatal result have occurred. Note that mechanical injury of the parts may result from other causes. In the absence of additional proof, a physician may only be able to state that the injuries are such as *might* be produced by rape. Inflammation, ulceration, and even gangrene of the vulva may also result from disease, as in the vaginitis and vulvitis of young children from worms, scrofula, uncleanly habits, erysipelas, malignant fevers, etc. In these, laceration and dilatation of the parts are absent; while the redness and purulent discharge are usually greater than follow violence.

Marks of Violence upon the Body.—In women previously accustomed to coitus these are important, as evidence of resistance on the part of the female. The genital signs may be wanting. Note extra form, position, and extent of any marks upon the body. If bruises exist, note presence or absence of color zones, indicating *date* of alleged assault.

Examination of Clothing.—Cut out stained spots from the clothing, whether dry or moist, and pale or colored, place in a watch-glass with just enough water thoroughly to moisten them for fifteen minutes, then squeeze out a few drops of their contents, and examine, under microscope, for *human* blood-corpuscles and spermatozooids of seminal fluid. The evidence thus afforded, it is plain, may or may not be important, according to circumstances. The same may be said of microscopical examination of vaginal mucus for spermatozoa, whether in the living or the dead. Loose fibres of clothing, examined microscopically as to their color and material, may sometimes furnish evidence of importance as to personal contact of persons wearing such clothing.

Examination for Venereal Disease.—The existence of gonorrhœa or syphilis, either in the male or female, and its conveyance from one to the other, may afford either negative or positive proof *pro re nata*. It should always be inquired into, and the time of its appearance after the alleged coitus, in the person said to have been infected by the other, duly noted.

Signs of Virginity.—The presence of an unruptured hymen affords presumptive, but not absolute proof that the female is a virgin. The hymen may be congenitally absent, or ruptured from causes other than coitus; and impregnation without vaginal penetration during intercourse, may take place, the hymen remaining intact.

Pregnancy Resulting from Rape.—It was formerly thought to be impossible. The contrary is now universally admitted. Conception may or may not occur, as after ordinary intercourse.

Impotence.—A medical opinion may be required as to sexual capacity, in a male accused of rape, bastardy, etc. Congenital impotence from defective development of organs is very rare. It is indicated by the individual being (usually) fat, without hair on the face, and none or but little on the pubes, by his testes and penis remaining small; his voice weak, and of the falsetto quality. There is complete absence of sexual desire, and a general deficiency of virile attributes. The age of puberty varies. It is usually from 14 to 17 years; exceptionally not until 20 or 21. Rape, legally defined to mean "some penetration," has been committed by boys of 13, 12, or even 10 years (cases in Taylor, p. 500). Procreation, however, is impossible until spermatozooids appear in the seminal fluid. They have been recognized microscopically at the age of 18, but may undoubtedly appear sooner. Boys have become fathers at 14, perhaps earlier (case of 14, in Taylor, p. 502). The beard, voice, development of the organs, and other marks of virility, should be our guides in any given case, rather than *age* alone.

A few cases are on record where puberty developed between the ages of two and three years. In one case (by Bruce Clark, *British Medical Journal*, February 6, 1886) hair appeared on the pubes at the age of eighteen months, and at four years of age this boy was as large as one at ten or twelve years, the penis being as large as that of a man, with morning erection, but the testicles were small, and there were no evidences of sexual desire or seminal emissions. The perineum and pubes were well supplied with hair, but it was absent in the axillæ.

Impotence from Advanced Age.—Procreative power has been retained till the age of 60, 70, 80, and 90 years. Such

individuals usually retain also an extraordinary degree of bodily and mental power. Sexual capacity may be lost much sooner. Age alone cannot define any limit.

Impotence from Loss of Organs, etc.—Loss of both testicles *does*, but loss of one *does not* render a man impotent. Examine for cicatrices, etc., upon scrotum. Even after removal of both, enough spermatic fluid may remain in the ducts during the first two or three weeks to confer procreative power. Persons in whom one of the testicles remains in the abdomen are not usually impotent. When both testicles remain undescended the individual may or may not be impotent—usually the former—according as the organs are or are not imperfect in their development. Medical opinion is to be based chiefly on signs of virility before stated, and on examination of secretion for spermatozoa.

As to impotence arising from injury of the generative organs, brain, spinal cord, etc., or from general diseases, a medical opinion must rest upon the circumstances attending each case.

APPENDIX.

REPORT on Uniformity in Obstetrical Nomenclature, adopted by the Section of Obstetrics of the Ninth International Medical Congress, held in Washington, D. C., September, 1887.

A. It is desirable to try to attain to uniformity in obstetrical nomenclature.

B. It is possible to arrive at uniformity of expression in regard to—

- I. The Pelvic Diameters.
- II. The Diameters of the Fœtal Head.
- III. The Presentations of the Fœtus.
- IV. The Positions of the Fœtus.
- V. The Stages of Labor.
- VI. The Factors of Labor.

C. The following definitions and designations are worthy of general adoption by obstetric teachers and authors:

I. PELVIC BRIM DIAMETERS.

1. Antero-Posterior:

1st. Between the middle of the sacral promontory and the point in the upper border of the symphysis pubis crossed by the *linea terminalis* — *Diameter Conjugata vera*, Cv.

2d. Between the middle of the promontory of the sacrum and the lower border of the symphysis pubis — *Diameter Conjugata diagonalis*, Cd.

2. Transverse:

Between the most distant points in the right and left iliopectineal lines = *Diameter Transversa*, T.

3. First Oblique:

Between right sacro-iliac synchondrosis and left pectineal eminence = *Diameter Diagonalis Dextra*, D. D.

4. Second Oblique:

Between left sacro-iliac synchondrosis and right pectineal eminence = *Diameter Diagonalis Læva*, D. L.

II. FŒTAL HEAD DIAMETERS.

1. From the tip of the occipital bone to the centre of the lower margin of the chin = *Diameter Occipito-Mentalis*, O. M.

2. From the occipital protuberance to the root of the nose = *Diameter Occipito-Frontalis*, O. F.

3. From the point of union of the neck and occiput to the centre of the anterior fontanelle = *Diameter Sub-Occipito-Bregmatica*, S. O. B.

4. Between the two parietal protuberances = *Diameter Bi-Parietalis*, Bi-P.

5. Between the two lower extremities of the coronal suture = *Diameter Bi-Temporalis*, Bi-T.

III. PRESENTATION OR LIE OF THE FŒTUS.

The *Presenting Part* is the part which is touched by the finger through the vagina, or which, during labor, is bounded by the girdle of resistance.

The *Occiput* is the portion of the head lying behind the posterior fontanelle.

The *Sinciput* is the portion of the head lying in front of the *bregma* (or anterior fontanelle).

The *Vertex* is the portion of the head lying between the fontanelles and extending laterally to the parietal protuberances.

Three groups of Presentations are to be recognized, two of which have the long axis of the fœtus in correspondence with the long axis of the uterus, while in the third the long axis of the fœtus is more oblique or transverse to the uterine axis.

1. Longitudinal.

(1) Cephalic, including—

Vertex and its modifications.

Face and its modifications.

- (2) Pelvic, including—
 Breech.
 Feet.

2. Transverse or Trunk, including shoulder, or arm, and other rarer presentations.

IV. POSITIONS OF THE FÆTUS.

The positions of the fœtus are best named topographically, according as the denominator looks—*first*, to the left or the right side, and *second*, anteriorly or posteriorly. When initial letters are employed it is desirable to use the initials of the Latin words.

In the case of the Vertex positions we have—

- Left Occipito-Anterior = *Occipito-Læva-Anterior*, O. L. A.
 Left Occipito-Posterior = *Occipito-Læva-Posterior*, O. L. P.
 Right Occipito-Posterior = *Occipito-Dextra-Posterior*, O. D. P.
 Right Occipito-Anterior = *Occipito-Dextra-Anterior*, O. D. A.

The Face positions are :

- Right Mento-Posterior = *Mento-Dextra-Posterior*, M. D. P.
 Right Mento-Anterior = *Mento-Dextra-Anterior*, M. D. A.
 Left Mento-Anterior = *Mento-Læva-Anterior*, M. L. A.
 Left Mento-Posterior = *Mento-Læva-Posterior*, M. L. P.

The Pelvic positions are :

- Left Sacro-Anterior = *Sacro-Læva-Anterior*, S. L. A.
 Left Sacro-Posterior = *Sacro-Læva-Posterior*, S. L. P.
 Right Sacro-Posterior = *Sacro-Dextra-Posterior*, S. D. P.
 Right Sacro-Anterior = *Sacro-Dextra-Anterior*, S. D. A.

The Shoulder *Presentations* are :

- ¹ Right Scapula-Posterior = *Scapula-Dextra-Posterior*, Sc. D. P.
¹ Left Scapula-Anterior = *Scapula-Læva-Anterior*, Sc. L. A.
¹ Left Scapula-Posterior = *Scapula-Læva-Posterior*, Sc. L. P.
¹ Right Scapula-Anterior = *Scapula-Dextra-Anterior*, Sc. D. A.

¹ Left and Right refer, in this section, in all positions, to the left and right side of the mother, without regard to that side of the child.

V. THE STAGES OF LABOR.

Labor is divisible into three stages.

1. First stage—from the commencement of regular pains until complete dilatation of the os externum — *Stage of Effacement and Dilatation*.

2. Second stage—from dilatation of os externum until complete extrusion of child = *Stage of Expulsion*.

3. Third stage—from expulsion of child to complete extrusion of placenta and membranes . *Stage of the After-birth*.

VI. THE FACTORS OF LABOR.

These are—

1. The Powers.
2. The Passages.
3. The Passengers.

D. Copies of the above resolutions shall be sent, in the name of the Section on Obstetrics of the Ninth International Medical Congress, to the various teachers and writers on obstetrics of the different nationalities represented at this Congress.

(Signed)

DE LASKIE MILLER, M. D.

President of the Section.

A. F. A. KING, M. D.

WM. T. LUSK, M. D.

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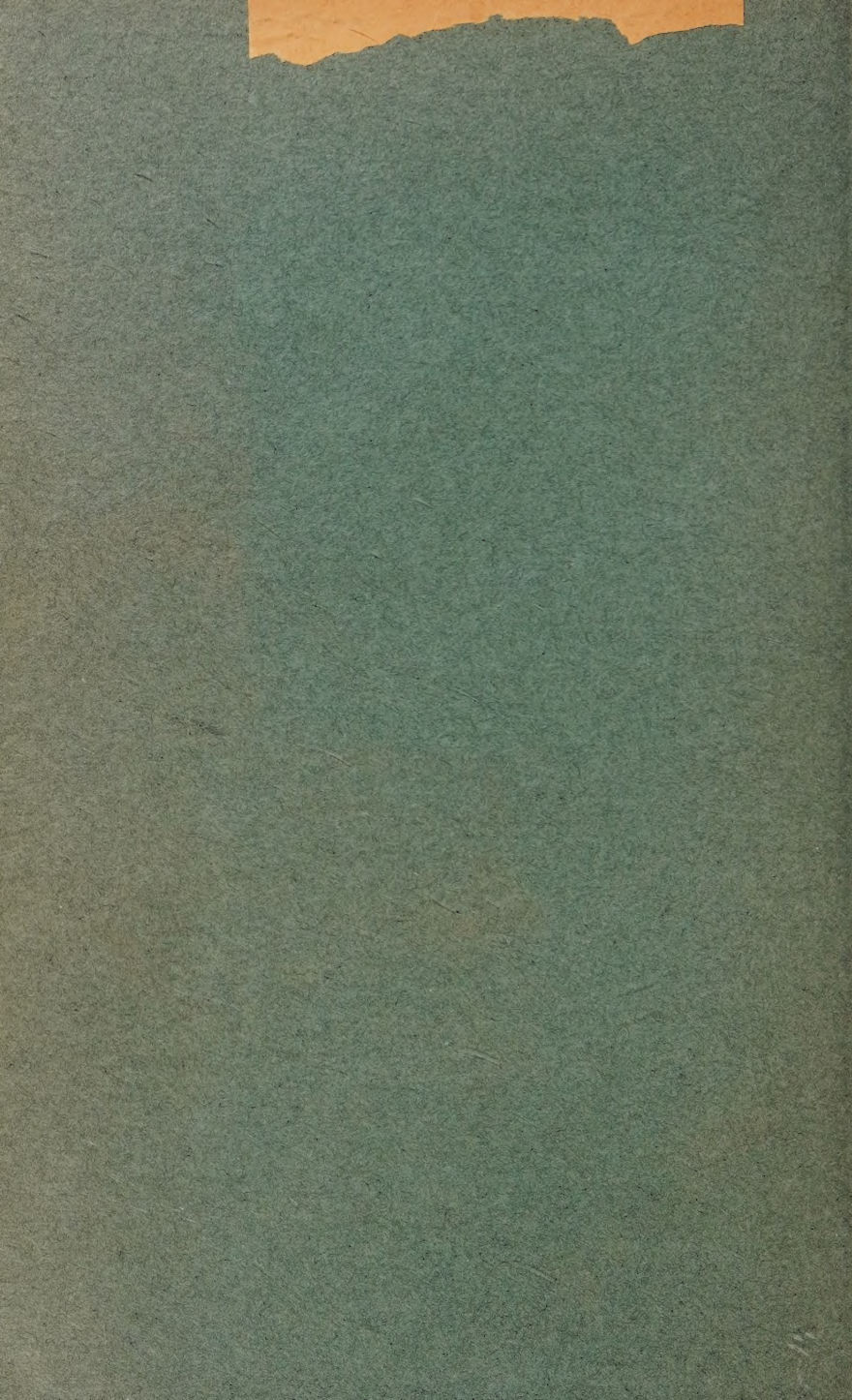
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